DOCUMENT RESUME

ED 183 957 CE 024 766

AUTHOR	Krone, Lawrence J.; And Others
TITLE	Curriculum Guideline for Environmental Health. Covers Period of Performance from June 22, 1978, to April 22, 1979.
INSTITUTION	National Environmental Health Association, Denver, Colo.
SPONS AGENCY	Health Resources Administration (DHEW/PHS), Bethesda, Md. Div. of Associated Health Professions.
PUB DATE	12 Nov 79
CONTRACT	231-77-0030
NOTE	110p.; Appendix B will not reproduce well due to broken type.
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	*Allied Health Personnel; Competency Based Education; Curriculum Design; *Curriculum Development; Curriculum Guides; *Environmental Technicians; *Job Skills; Occupational Information; Student Evaluation; *Task Analysis; Teaching Methods

ABSTRACT

This curriculum guide for environmental health is intended as a reference tool to aid institutions in establishing or revising their curriculum. After a brief introduction discussing competency-based curriculum for environmental health, the guide presents information on the following tasks or elements necessary in developing a competency-based curriculum: (1) defining the performances; (2) defining knowledge, skill, and attribute competencies; (3) defining objectives; (4) learning opportunities; (5) curriculum sequence; (6) teacher strategies; and (7) student appraisals. A definition of the profession of environmental health is included, and recommendations to be followed in developing a program are given. A discussion of problems and solutions and a list of references concludes the guide. Several supporting materials are appended, such as the Role Delineation Instrument and the Blueprint of the Knowledge, Skills, and Attributes for Environmental Health Practitioners. (BM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ERIC

HRP 0902173

ED183957

Contract #HRA 231-77-0030
Deliverable Item #8
Due Date: April 22, 1979
Actual Date of Presentation:
November 12, 1979

CE

CURRICULUM GUIDELINE FOR ENVIRONMENTAL HEALTH

covers period of performance from
June 22, 1978 to April 22, 1979

Contractor:
National Environmental Health Association
1200 Lincoln, Suite #704
Denver, Colorado 80203

Sponsor:
Department of Health, Education, and Welfare
Health Standards Manpower Branch
Division of Associated Health Professions
BHM, HRA, Hyattsville, MD 20782

This report is made pursuant to contract #HRA 231-77-0030. The amount charged to DHEW for the work resulting in this report is $58,161.00.

Names of persons employed by the contractor with managerial and professional responsibility for such work and for the content of the report are as follows:

Lawrence J. Krone, Ph.D., Project Director
Karl L. Ford, M.S., Research Associate
Linda F. Worrell, B.S., Research Assistant
Florence M. Kent, M.A., Research Assistant

CE 024 764

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

PREFACE

This report was prepared by the National Environmental Health Association to fulfill the requirements for Contract HRA #231-77-0030, submitted to the United States Public Health Service, Health Resources Administration, Bureau of Health Manpower, April 22, 1979. Contributing to this report were Lawrence J. Krone, Ph.D., Project Director, Karl Ford, M.S., Research Associate, Linda Worrell, B.S., Research Assistant, and Florence M. Kent, M.A., Research Assistant. Recognition for contributions in the earlier stages of the report goes to Robert Powitz, Ph.D.

The work described in this report began June 22, 1977, and was completed April 22, 1979. The project staff was assisted by three expert committees and special consultants, all of whom are listed in the report.

The final phase of this contract, to develop curriculum guidelines, was completed based on the verified and refined Role Delineation Instrument.

Special gratitude is extended to Mr. William Holland, Project Officer, Washington, D.C., for his continued advice and encouragement throughout the project.

Special appreciation is also extended to Ida Marshall and Jean Dyer, as well as other members of the National Environmental Health Association staff, for their guidance and assistance throughout the contract period.

3

MAY 1 1980

TABLE OF CONTENTS

Preface..... 1
Forward..... 1
Introduction..... 3
Introduction to a Competency-Based Curriculum for Environmental Health..... 5
Curriculum Guide..... 6
- Defining the Performances..... 6
- Knowledge, Skill, and Attribute Competencies..... 10
- Defining Objectives..... 15
- Learning Opportunities..... 21
- Curriculum Sequence..... 22
- Teacher Strategies..... 27
- Student Appraisals..... 33
- The Profession of Environmental Health.... 35
- Recommendations..... 36

Project Director's Discussion of Problems and Solutions..... 39
References..... 41

Appendices
- A Fourteen Program Areas in Environmental Health
- B Role Delineation Instrument
- C Blueprint of the Knowledge, Skills, and Attributes, for Environmental Health Practitioners
- D Project Participants

Foreward

Environmental Health is that discipline characterized by multi-disciplinary efforts toward controlling, preserving, and improving environmental factors to achieve optimum health and safety for all people. The environmental health practitioner has been identified in various professional career categories of which the job title "sanitarian" has endured for more than forty years. The sanitarian is basically a hygienist in that he represents a multi-disciplinary effort in applying medical, ecological and technical knowledge and skills to achieve health and environmental goals.

As specialists in environmental health, the sanitarian's work involves protection of human food, water, air and shelters. Sanitarians inspect restaurants, hospitals, recreational areas and housing to insure cleanliness and safety and to prevent the occurrence of disease-causing organisms and chemical contamination. They work to control air pollution, water pollution and land pollution. They sample air and water supplies and oversee the proper handling of waste materials. They help control noise and other community environmental problems. Sanitarians, and other environmental health personnel, use sampling procedures, health and environment related regulations, and educational methods to help provide an environment that promotes the good health and well-being of people.

After working for several years as an entry-level generalist, the sanitarian may specialize in one program area. Sanitarians are employed by local, state and federal health and environmental agencies, industry and universities. Historically, sanitarians have been employed in governmental settings; however, today the trend is toward greater industry employment.

Approximately 25,000 environmental health practitioners are considered sanitarians; whereas, there are more than 100,000 more specialized persons employed in the area of health and the environment, particularly in pollution control. Appendix A lists and describes the 14 environmental health program areas. Moreover, Morgan et. al., 1968, estimated the annual need for sanitarians in the job market at 3,000[1] and the population of the U.S. has since increased by more than 25 million. These facts point out the fact that there is a demand for professionals educated and trained to assume a career in environmental health. The last decade has seen a renewed public interest in health and the environment and this concern has resulted in increased federal legislation in both health and the environment and more jobs in the environmental health sector.

I. Introduction

This Curriculum Guide is intended to be a reference tool only and is not intended to be a prescription for academic institutions. With the rapid growth of environmental health curricula around the country, it is believed that a curriculum reference tool would be a helpful aid to institutions establishing or revising their curriculum. The staff of various universities and state training curricula have indicated to the project staff of the National Environmental Health Association (NEHA) that some important principles or concepts are not being considered in some programs.

A 1978 questionnaire of university and state training programs revealed that many programs lack a comprehensive treatment of the competencies necessary for effective practice. Most university and state training programs lacked treatment of competencies concerning environmental law and attributes. Others lacked curricula concerning disease causation, data collection, administration or communications. While most schools and states had a general curricula, less than one-half provided specific classwork in one or more program areas.[2]

Another 1978 query of 849 members of the NEHA indicated that university and training efforts could be improved by placing more emphasis on such items as problem-solving, ethics, and internships.[3] The members responding to the checklist strongly supported continuing competency education and also saw a need for such an ongoing program linked to a future recertification program.

The Curriculum Guide is intended to serve as a competency based resource document for environmental health curricula. Competencies are derived from practitioner functions and major responsibilities that have been defined in the Role Delineation Instrument (see Appendix B). The Curriculum Guide is a map of a broad-based, multi-disciplinary curriculum building

on the basic physical and natural sciences. The document is not a prescription but rather a reference tool for educators and trainers in environmental health.

A resource guide such as this can be utilized by: 1) universities in preparing students with the initial competencies for entry-level positions; 2) by state training officers preparing new employees with both initial and continuing competencies; and 3) by institutions providing continuing competency training for the field practitioner. It may prove particularly useful for academic institutions in developing new environmental health curricula, or revising current curricula and for institutions preparing for accreditation of their environmental health curriculum.

This guide also contains the verified role delineation that describes in great detail the functions and major responsibilities for sanitarians. These data are of use to environmental health administrators and personnel officers engaged in developing job descriptions, job qualifications and standards of performance.

II. An Introduction to a Competency Based Curriculum for Environmental Health

The major goal of any environmental health educational or training program is to help the student develop the competencies necessary for effective practice. Competency based education may be defined as a performance-oriented process designed to bring about the demonstration of those knowledges and skills that reflect successful career practice. Competency based education has certain advantages in that:

1. Progress is dependent on student performance rather than time spent in class.
2. Student learning is directly related to course objectives rather than to instructional materials.
3. It enables a more objective evaluation of student performance.
4. There is congruity between course objectives and evaluation instruments.[4]

Perhaps the greatest obstacle in implementing competency based education is the time involved in initial program development. The steps in the development of a competency based program include development of the performances, knowledge and skill competencies, objectives, learning opportunities, curriculum sequence, teacher strategies, student evaluation instruments and curriculum evaluation methods.

The Role Delineation Instrument (RDI) and the KSA blueprint are the building blocks of this guide. They were developed from the input of numerous expert committees, including representation from academic institutions and from the field, and also from checklists completed by field practitioners. As such, these components represent more than two years effort from committees, from practitioner verification and by research staff. A final phase is underway which will develop a competency based practitioner (or student) evaluation instrument (see p. II).

III. Curriculum Guide

The Curriculum Guide is designed to be a resource document that provides guidance to educators and trainers on how to develop or improve an institution's environmental health curriculum. The Curriculum Guide has undertaken each of the competency based steps as they apply to environmental health: 1) The performances are defined in the RDI which has already been disseminated to key governmental agencies; 2) The knowledge and skill competencies have been identified in the Blueprint; 3) sample objectives are defined and given here in the Curriculum Guide along with; 4) learning opportunities; 5) a definite curriculum sequence; 6) teacher strategies; and 7) student appraisal techniques. Please note that what the NEHA has produced above on a complete competency based program is that which is called for by Dr. May in her article on competency based education, namely:

1. Developing the competencies
2. Program Objectives
3. Curriculum Sequence
4. Curriculum Evaluation
5. Learning Experiences
6. Student Evaluation Instruments [5]

With the tools contained in this guide, it is hoped that an educator, trainer, or curriculum planner can design a meaningful environmental health curriculum.

1. Defining the Performances

In previous documents, the National Environmental Health Association has developed and refined a role delineation instrument (RDI) for environmental health.[6] Three position classifications have been identified in this study to represent the generic practitioner groupings in the field.

"Position Classification" refers to a system of categories for practitioner positions. A position is a specific practitioner grouping based on the performance of activities. The position classification developed as a result of this study is based on the career category traditionally referred to as the Sanitarian.

The purpose of a position classification is to clearly differentiate the various kinds of environmental health positions and establish their relationships to each other. The classification serves as the framework from which to define the Major and Specific Responsibilities of practitioners, and also serves to clarify potential career mobility pathways. The position categories have been identified as:

Position #1: that environmental health practitioner who is involved primarily in inspections, field sampling and testing; enforcement and public information activities.

Position #2: that environmental health practitioner who is involved primarily in educational, investigative, consultative, planning and enforcement activities.

Position #3: (Administrative) that environmental health practitioner who is involved primarily in supervisory, administrative and planning activities; directs enforcement and investigative programs.

Position #3: (Technical) that environmental health practitioner who is involved primarily in directing educational and investigative programs; acts as a consultant to industry and governmental agencies; and demonstrates administration ability in environmental management.

The focus in this study on the above three identified positions does not necessarily exclude the existence of other environmental health positions that may be found from state to state. Furthermore, combinations of activities may exist that are different from those identified above. The position classification system given in this report is a generic system

developed for national use as a flexible framework within which to describe what the environmental health practitioner does on the job.

The Role Delineation Instrument contains two main parts for each position identified as Major Responsibilities and Specific Responsibilities.

Major Responsibilities

Major Responsibilities refer to the broad area of performance executed by a practitioner. The following describes the characteristics of Major Responsibilities, namely they are:

a. Expressed as performances

b. All Encompassing

c. Include Attributes

PERFORMANCES can be viewed as the activities carried out by the practitioner. To express a responsibility as a performance is to express the action involved. For instance, if the practitioner is responsible for the collection of samples and specimens, this would be expressed as a performance by stating: "Collects samples and specimens." The action word "collects" expresses the performance executed by the practitioner.

ALL-ENCOMPASSING refers to broad areas of performance or large groupings of activities. Major Responsibilities are stated so that a number of related and component activities are encompassed. For instance, the Major Responsibility, "performs routine field tests," encompasses a number of related specific activities, such as "prepares testing apparatus for operations" and "conducts basic measurements and calculations."

ATTRIBUTES are emotional characteristics or qualities that reflect the practitioner's values and attitudes. Attributes are by nature "intangible" and, therefore, difficult to define or assess in an objective manner. Fre-

quently, however, a given practitioner's attributes, as reflected in job performance, may make the crucial difference in his success or failure in providing quality environmental health services. This is particularly true in cases requiring effective interaction with persons contacted during the course of work; e.g., interpersonal activities as opposed to those of a strictly technical nature.

SPECIFIC RESPONSIBILITIES

Specific Responsibilities are essential for the execution of each Major Responsibility. Specific Responsibilities have the following characteristics:

PERFORMANCES, as stated previously, are activities carried out by the practitioner. For example: Major Responsibility stated as performance: "Collects samples or specimens for laboratory analysis." Specific Responsibilities stated as performances: "Locates sampling site geographically, transports sample or specimen to laboratory."

As shown in the example, action is emphasized (locates, transports) in order to express the Specific Responsibility in terms of actual practitioner performances.

Since Specific Responsibilities reflect the essential components of a Major Responsibility, they include both interpersonal and technical activities. However, these two types of Specific Responsibilities have not been placed in separate sections. Rather, the Specific Responsibilities are listed in logical order (outline-style) to express how they relate to one another in executing the Major Responsibility.

KNOWLEDGE AND SKILL COMPETENCIES describe the practitioner's abilities in performing his job proficiently, based upon his knowledge and skills. The Role Delineation Instrument incorporates this aspect into state-

ments of Specific Responsibilities. Knowledge and skills are inherently stated in the descriptions of practitioner activities. For instance, in the Major Responsibility, "Collects samples or specimens for laboratory analysis," one of the Specific Responsibilities is stated as, "Utilizes the necessary equipment in conducting sampling procedures." This Specific Responsibility describes a skill competency that the practitioner must possess the ability to use sampling equipment. However, the skill is described as a performance activity and is, therefore, inherently stated in the Specific Responsibility.

2. Defining the Knowledge, Skill and Attribute Competencies

The next step in the competency based process is to identify the knowledges, skills, and attribute competencies (KSA's) necessary for effective performance. Since KSA's are inherent, but not explicit, in the performances, i.e., (RDI major and specific responsibilities), a way was devised to make them more explicit. The performances were easily translated into skills and then the knowledges were identified by the use of consultants, expert committees, and research. A detailed Blueprint of the Knowledge, Skills and Attributes for Environmental Health Practitioners is contained in Appendix C.

The project staff quickly found, however, that many knowledges could pertain to any of the described performances, and that several may apply to each performance. For example, knowledge of disease causation is equally important to conducting an inspection as conducting an investigation or to communicating information to the public. Since the problem seemed to be just a matter of degree, the staff and committees identified the most essential

knowledges and skills for each performance.

A Knowledge and Skill Competency Guide has been prepared to link the major competencies to the performances of the RDI, (Figure 1). This guide may be used in conjunction with the Blueprint to identify the competencies applicable to each performance. For example, in the performance, Samples (I.I), the most essential knowledge and skill competency concerns the Acquisition of Environmental Health Data. Turning to the Table of Contents in the Blueprint (Appendix C), the detailed knowledge and skills pertinent to this competency are described in pages 30-36.

The KSA blueprint was extensively researched and developed through the assistance of three expert committees, consultants, and the project staff. Committee participants and consultants who participated in this effort, are listed in Appendix D. The KSA's were also submitted to a checklist verification by field practitioners in 41 states. The KSA blueprint that has emerged reflects broad-based input from practitioners, educators, trainers, and the project staff.

It is important to note a few features of the KSA Blueprint. The document does not provide detailed content material for differing program areas. Since all efforts on this project have been directed at the entry level generalist, the program speciality areas are not treated in depth. Instead, the Blueprint focuses on the principles and concepts of environmental health practice that are common to all program areas. The five basic knowledge/skill categories described in the Blueprint are:

I. Knowledge of Disease and Injury Causation and Control Techniques

II. Knowledge of Administrative Law and Process

POSITION I KNOWLEDGE AND SKILLS REQUIRED BY MAJOR RESPONSIBILITY CATEGORIES OF ROLE DELINEATION INSTRUMENT

I. Inspects --- The most essential knowledge and skills needed are concerned with:

(1) Disease and Injury Causation
(2) Disease Control and Prevention Processes
(3) Human Needs
(4) Interpersonal Communications

II. Approves Permits --- The important knowledge and skills needed concern:

(1) Legality of Agency Administration Actions
(2) Personal and Agency Liability

III. Samples --- The most essential knowledge and skills needed concern the acquisition of environmental health data.

IV. Field Tests --- The most essential knowledge and skills needed are concerned with the acquisition of environmental health data.

V. Communicates --- The most essential knowledge and skills needed concern interpersonal communications.

VI. Investigates --- The most essential knowledge and skills needed are concerned with:

(1) Disease and Injury Causation
(2) Disease Control and Prevention Processes
(3) Human Needs

VII. Reviews Plans --- The most essential knowledge and skills needed concern disease control and prevention processes.

VIII. Represents Department --- The most essential knowledge and skills needed concern interpersonal communications.

IX. Cooperates with Staff --- The most essential knowledge and skills needed concern interpersonal communications.

FIGURE 1: Knowledge and Skill Competency Guide

POSITION II KNOWLEDGE AND SKILLS REQUIRED BY MAJOR RESPONSIBILITY CATEGORIES OR ROLE DELINEATION INSTRUMENT

I. Communicates --- The most essential knowledge and skills needed concern:

(1) Human Needs
(2) Interpersonal Communications
(3) Group Behavior
(4) Use of Mass Media

II. Investigates --- The most essential knowledge and skills needed concern:

(1) Disease and Injury Causation
(2) Agency Acquisition and Retention of Information
(3) Acquisition of Environmental Health Data
(4) Utilization of Environmental Health Data
(5) Interpersonal Communications

III. Consults --- The most essential knowledge and skills needed concern:

(1) Disease and Injury Causation
(2) Disease Control and Prevention Processes
(3) Acquisition of Environmental Health Data
(4) Utilization of Environmental Health Data
(5) Interpretation of Environmental Health Data
(6) Interpersonal Communications
(7) Group Behavior
(8) Human Needs

IV. Inspects --- The most essential knowledge and skills needed concern:

(1) Disease and Injury Causation
(2) Acquisition of Environmental Health Data
(3) Interpersonal Communications
(4) Group Behavior

V. Supervises --- The most essential knowledge and skills needed concern:

(1) Knowledge of Organizations
(2) Management Principles
(3) Program Planning and Evaluation
(4) Human Needs

FIGURE 1 (Cont'd): Knowledge and Skill Competency Guide

(5) Interpersonal Communications
(6) Group Behavior
(7) Use of Mass Media

VI. Participate in Planning Programs --- The most essential knowledge and skills needed concern:

(1) Disease and Injury Causation
(2) Source and Nature of Authority
(3) Acquisition of Environmental Health Data
(4) Utilization of Environmental Health Data
(5) Interpretation of Environmental Health Data
(6) Knowledge of Organizations
(7) Program Planning and Evaluation
(8) Human Needs
(9) Interpersonal Communications
(10) Group Behavior
(11) Use of Mass Media

VII. Reviews Plans and Specifications --- The most essential knowledge and skills required concern:

(1) Disease Control and Prevention Processes
(2) Utilization of Environmental Health Data
(3) Interpretation of Environmental Health Data

VIII. Represents Department --- The most essential knowledge and skills required concern:

(1) Disease and Injury Causation
(2) Disease Control and Prevention Processes
(3) Human Needs
(4) Interpersonal Communications
(5) Group Behavior
(6) Use of Mass Media

IX. Liaison --- The most essential knowledge and skills required concern:

(1) Disease and Injury Causation
(2) Disease Control and Prevention Processes
(3) Source and Nature of Authority
(4) Enforcing Laws
(5) Knowledge of Organizations
(6) Interpersonal Communications
(7) Group Behavior

X. Cooperates with Staff --- The most essential knowledge and skills required concern:

(1) Interpersonal Communications
(2) Group Behavior

FIGURE 1 (Cont'd): Knowledge and Skill Competency Guide

III. Knowledge of the Utilization of Resources in the Collection, Arrangement, and Interpretation of Data

IV. Knowledge of Environmental Health Administration

V. Knowledge of the Behavioral Sciences

It is the belief of those who participated in developing the KSA blueprint that if the entry-level generalist has the knowledges and skills contained in the blueprint, then he can perform at the entry-level with only minimum in-service, or "on-the-job" training in any of the more specialized program areas.

As a final note on the KSA document, attention should be drawn to the "weighting" of the Blueprint. With the input of the expert committees, a weighting scheme was developed to describe the relative weights each category should receive in student instruction and evaluation. The description and figures are contained in the introductory section, "How to Use This Document." This information should be of value to curriculum planners in developing courses and content since the same blueprint and weighting scheme is being utilized in the development of the revised proficiency examination for environmental health, (scheduled for completion in 1980).

3. Defining Objectives

Since the role delineation instrument describes the detailed performances needed by the entry-level practitioner, and the performances describe the knowledge and skill competencies, the next step in the competency based approach is to specify objectives. Mager defines the learning objective as, "an intent communicated by a statement of what the learner is to be like when he has successfully completed a learning experience. It is a description of a pattern of behavior (performance) we want the learner to demonstrate."[7] The purpose of learning objectives is to make the teaching,

learning, and evaluation process more explicit and better related to the necessary competencies. However, it is important to note that a hierarchy of objectives usually exist.

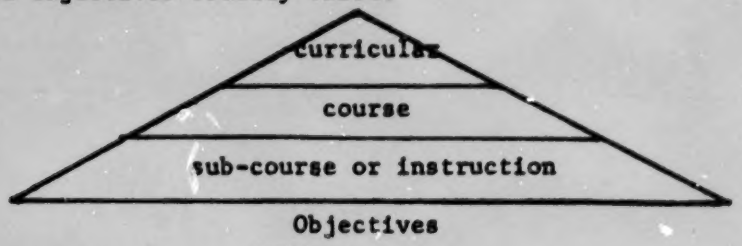


Figure 2: Hierarchy of objectives

Objectives are needed at the curricular level, course level, and sub-course or instructional level. Objectives derived from the RDI major responsibilities and knowledge and skill competencies may be suitable curricular objectives; whereas, objectives stemming from the specific responsibilities and their derivative knowledge and skill competencies may be most suited to course objectives. Figure 3 illustrates how objectives are derived from the competencies which in turn, are derived from the performances, and it also shows the hierarchy that is involved.

Sample curriculum objectives for the entry-level position #1 are contained in Figure 4. These objectives are keyed both by RDI performance and by the KSA competency. A curriculum planner should consider these as a sampling of general curricular objectives only.

PERFORMANCE	KNOWLEDGE AND SKILL COMPETENCIES (KSA's)	OBJECTIVES
Major Responsibility (III)		Curriculum Objective
"Collects samples and specimens for laboratory analysis."	Acquisition of Environmental Health Data (Blueprint, p. 30-36)	"The student shall describe equipment used in air, water, food, energy, structures, and vector sampling and testing."
Specific Responsibility		Course Objective
"Locates designated sample geographically."	Criteria for Selection of Sampling and Testing. (Blueprint, p. 36)	"The student shall list and describe four factors that guide the selection of the sample location."
		Instructional Objective
	Knowledge of sample network (Blueprint, p. 36)	"The student shall identify and locate the sampling stations contained in a sample network."

FIGURE 3: Derivation of objectives from competencies and competencies from performances showing hierarchial nature of each.

POSITION LEVEL #1

These objectives are based on: (1) Tool competency statements for NEHA Self-Assessment Tool, (2) RDI - KSA linkages performed by Criteria/Topic Committee, and (3) Delineation of minimum competencies for position level #1 performed by Criteria/Topic Committee. All other competencies described in these documents are for position levels #2 or #3.

KSA CATEGORY (See Appendix C)		RDI CATEGORY (See Appendix B)
IA	1. Describe the host-agent and multifactoral theories of disease causation, including chronic diseases and injury.	(I, VI, VII)
	2. Associate etiological and causative agents with their resultant disease.	
	3. List and discuss the elements in the chain of infection that is common to the mode of transmission of infectious diseases.	
	4. List the portals of entry.	
	5. List several toxicological concepts.	
	6. List and compare host and environmental factors important in disease causation.	
	7. Solve elementary epidemiological problems.	

FIGURE 4: Sample Objectives for an Environmental Health Curricula.

KSA CATEGORY		RDI CATEGORY
IB	1. List environmental health disease prevention or control measures and identify examples of each.	(I, VI, VII)
IIB	1. Identify the legal authority for conducting inspections.	(II)
IIC	1. Compare the legal basics for permits, license, and registration.	(II)
	2. Compare the terms: embargo, seizure, and condemnation.	
	3. Describe the legal basis of administrative rules and regulations.	
IIE	1. List types of personal and agency liability.	(II)
IIIA	1. List sources of environmental health information.	(III, IV)
	2. Describe equipment used in air, water, food, energy, structures, vectors sampling and testing.	
	3. List examples of personal protective equipment.	
	4. Interpret the importance of sample location.	
	5. Conduct simple mathematical calculations necessary to sampling and testing methods.	
VA	1. List a hierarchy of human needs and identify examples of each.	(I, V, VI, VIII, IX)
	2. Utilize methods of proper verbal, non-verbal, and written communication.	

FIGURE 4 (continued)

KSA CATEGORY		RDI CATEGORY
VA (continued)	3. Recognize other people's values or philosophy.	(I, V, VI, VIII, IX)
	4. Utilize motivational techniques.	

FIGURE 4 (continued)

4. Learning Opportunities

The purpose of this section is to briefly describe the learning progression of the KSA blueprint and how it is related to learning opportunities. Contained in outline form, the Blueprint goes from the general to the specific. It has been previously stated that the more general headings could be utilized in developing curricular objectives and that the more specific headings could assist in developing course or instructional objectives.

The blueprint, however, does not differentiate between positions #1 and #2. University baccalaureate programs, and in a few cases, associate programs will normally produce graduates who will find employment at position #1. External degree programs exist for practitioners without the baccalaureate degree. The best guidance in drawing the line between the two position levels is to refer to the Sample Program Objectives (Figure 4). These objectives describe what KSA's the research staff and committees consider necessary for the position #1. Position #2 requires more advanced knowledge and skill competencies than does #1. These positions are generally filled by practitioners who have acquired the competencies from a combination of experience and undergraduate education or from graduate education alone. The competencies for position #3 differ from those of #2 mainly by the ultimate responsibility of planning and directing environmental health programs, while position #3b requires competencies in directing educational and investigative programs. Experienced practitioners without administrative or advanced technical education have filled these positions in the past, but the trend is towards the proper combination of experience (3 to 5 years minimum) and graduate education with emphasis in environmental health or administration.

The Blueprint features content on the traditional communicable diseases and their control but also contains newer material on toxicology, noise, radiation, and other aspects that cause non-infectious disease. It is these areas that many field practitioners are deficient in and require continuing competency education. It should be acknowledged that the Blueprint does not contain all of the content for any of the position levels. It is only a general outline and requires augmentation from the literature, personal experience, and other instructional materials.

5. Curriculum Sequence

In developing any curriculum, it is necessary to look at the competencies first, and work backward. The National Accreditation Council for Environmental Health Curricula determined that certain basic science domains form the foundation for successful performance. The Council recommends 80-90 semester hours (120-135 quarter hours) in the basic arts and sciences: [8,9]

Educational Domains in Environmental Health

Classical Academic Domain

Physical Science	Biological Science	Social Science	Communications/ Humanities
Chemistry Inorganic	Biology	Economics	Technical Writing
Chemistry Organic	Physiology	Sociology	English Composition
Physics	Zoology	Psychology	Speech
Algebra	Ecology	Political Science	Human Relations
Trigonometry		Anthropology *	Literature
Statistics			Philosophy
Biochemistry			

FIGURE 5: Classical Educational Domains in Environmental Health
*Indicates recommended elective.

These course requirements are normally fulfilled outside of the department in the student's first two years. Junior and senior years become more specialized in environmental health and supporting courses. These courses may be called the Applied Educational Domain:

Applied Educational Domain

(Biomedical or Health Science)

Biostatistics	Microbiology	Health Education
Epidemiology	Toxicology	Community Health Organization
	Public Health Entomology	Public Health Organization
	Environmental Health	and Administration
	Field Experience	

FIGURE 6: Applied Educational Domains in Environmental Health

These courses are recommended by the Council to supply a minimum of 30 to 40 semester hours (45-60 quarter hours), of which 12-15 semester (18-24 quarter hours) minimum should be environmental health.[10]

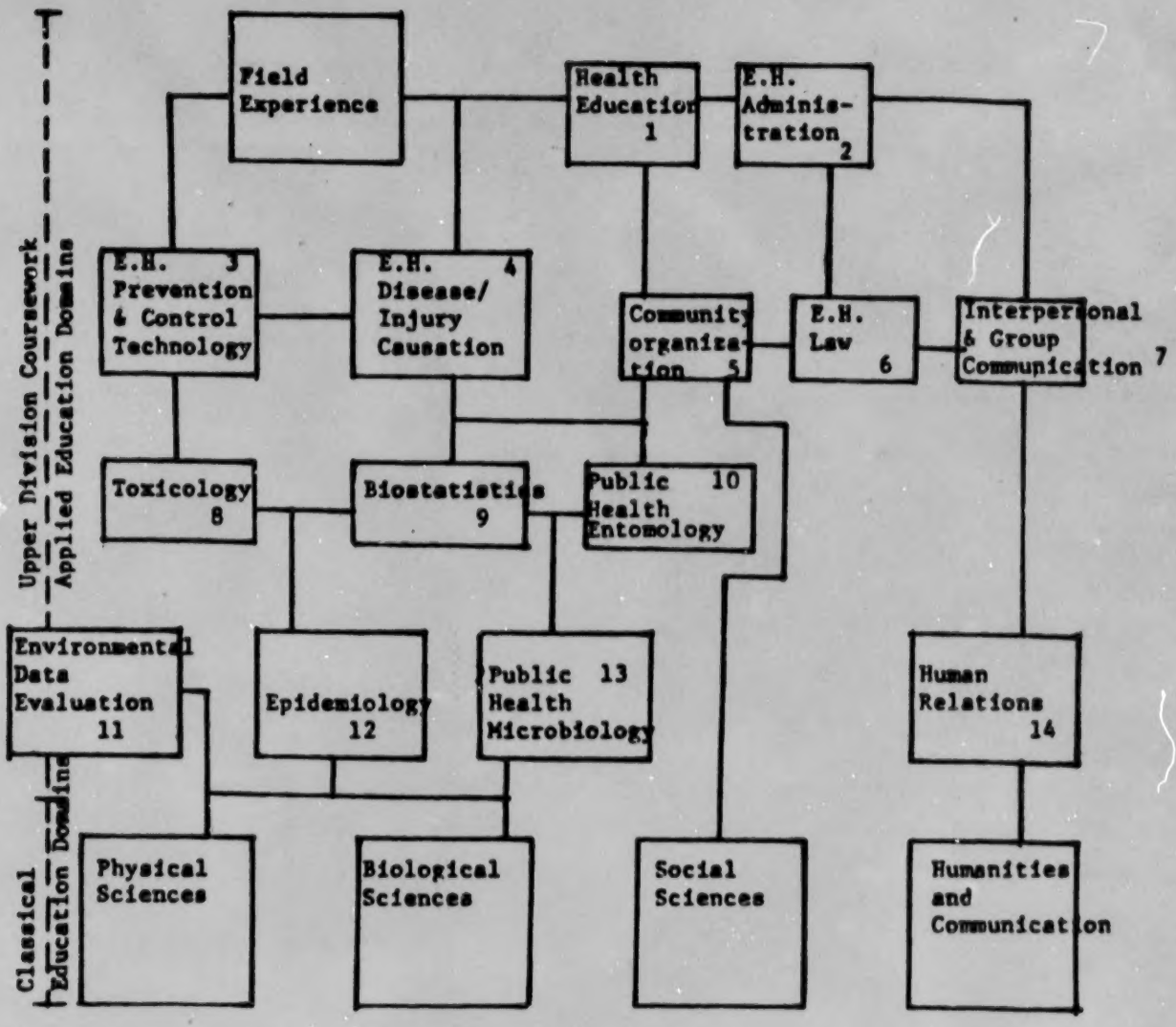
In 1978, the National Council on Environmental Health Internships, which is a council in liasion with the National Environmental Health Association, recommended to the Accreditation Council that a minimum ten-week internship be made a mandatory requirement, rather than desirable. This recommendation failed to pass the Accreditation Council, primarily for reasons of student hardship. The Accreditation Council, however, continues to recommend field experience.[12] In all cases, internships are strongly suggested by the Internship Council, but not mandatory for accreditation.

A sample curriculum sequence is shown in Figure 7. The student enters the program taking courses from the classical domain, and then progresses to the applied domains in his junior and senior years. The sequence, relationships with prerequisite courses and references to the blueprint are contained within the figure.

In short,

> "If anything seems clear today, it is that the complex business of health touches many areas of life, and it is quite difficult to know at any one time in what area of knowledge the answers to the next public health problem will lie: in the biological sciences, in the physical sciences, in economics, community motivation, or organization, or in the arena of political decision making." [23]

Whatever the case, it is best to be prepared in all areas in order to meet the challenge.



Blueprint Reference: (pages)

1. 42 - 43	6. 22 - 30	11. 30 - 36
2. 36 - 40	7. 40 - 41	12. 12 - 17
3. 19 - 22	8. 7 - 9, 12 - 14	13. 2 - 5
4. 2 - 18	9. 36	14. 40 - 43
5. 40 - 43	10. 35	

Figure 7: Sample Curriculum Model for Environmental Health, including references to KSA Blueprint.

The Curriculum Guide recognizes that each institution has its own special curriculum requirements and goals which are governed by regional needs, resources, facilities, and faculty. If a change in the curriculum is envisioned for a university program, the curriculum planner should be aware that internal and external obstacles to change exist. Nevertheless, certain strategies may be employed to facilitate curriculum change. If teaching and curriculum development are rewarded with prestige and advancement, it is possible to spark a greater interest in this area. Also, funding agencies and students may insist on a more relevant curriculum, or research in education may further support the need for change.[14]

Curriculum evaluation is a part of the continuous curriculum development cycle. With competency based education, it is possible to evaluate the students in terms of mastery of the curricular objectives and performance competencies. Since environmental health is a dynamic field, its performances and competencies are changing at a rapid pace. It is the institution's responsibility to re-evaluate the traditional or status quo competencies in terms of the ideal competencies needed by today's professionals.[15]

Today there are formal classroom settings in which to obtain a degree and informal settings (e.g. external degree programs). Non-traditional programs offer individuals the opportunity to obtain course credit for experiences, seminars, and classroom work on or away from the campus. One such non-traditional program exists in environmental health, namely the program at Ferris State College.

By comparing the traditional with the ideal, institutions can respond to changing needs of the profession and the student, and in so doing, infuse greater vitality into the profession. By way of example, for many years academic programs in sanitary science or environmental health restricted themselves to control of communicable diseases. Today's environmental health practitioner needs to understand the disease process in terms of the causation of non-infectious disease, including radiation, toxicology, occupational health, noise and environmental pollutants. It is hoped that the KSA Blueprint and the RDI will be effective tools in assisting institutions to identify new performance roles and competencies affecting environmental health.

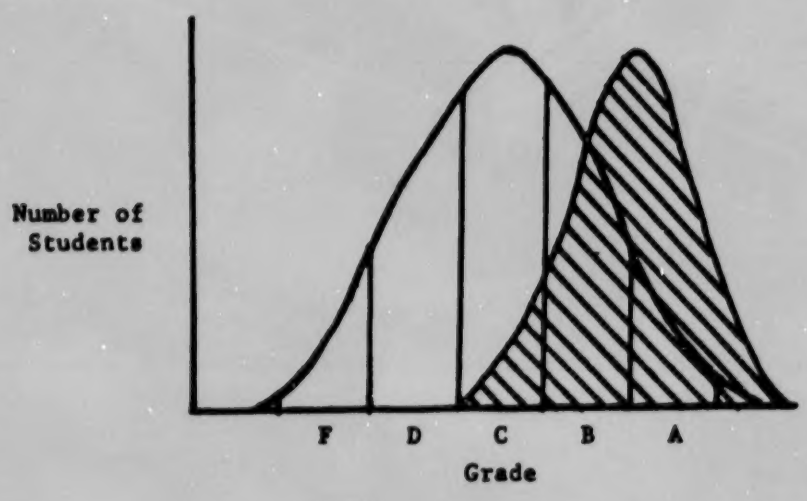
One way to make the comparison of traditional versus ideal competencies is to survey graduates of the program. Their insights will prove useful in describing the needs of the practitioners.

6. Teacher Strategies

There are several approaches to teaching. This reference document has advocated the competency-based process over the subject-centered, or traditional approach. One component of competency-based education pertinent to teacher strategy is mastery learning. Mastery learning is grounded in the principle that students of the same intellectual quality as those now in environmental health programs, when given the appropriate instruction, can master the prescribed basic performance objectives. Essentially, students progress at their own rate until they can master each instructional course objective. Since the student has a copy of the instructional objective for each module of every course, the student knows exactly what he is to be evaluated on. With frequent assessment and proper instruction, the goal of mastery learning is to have at least 90% of the students achieve 90% of the competencies 90% of the time.[16]

This system avoids the built-in mediocrity of traditional methods where some students and/or instructors are satisfield with minimally acceptable performance. Another way of expressing it is that mastery learning enables 75-90 percent of the students to achieve the same high level as the top 25 percent learning under typical group-based instructional methods. Figure 8 compares a normal distribution of grades for a typical class evaluation with the mastery distribution. It may be seen that mastery learning assures a much higher overall class performance than does the typical system. However, with a little effort it seems that mastery learning may have important application to environmental health courses that can be designed as self-pacing, particularly for continuing education packages.

FIGURE 8: Superimposed mastery learning curve on traditional "normal curve".[17]



Having discussed the mastery learning approach, the next items to address are instructional methods and environmental health applications. Figure 9 lists some of the various instruction methods:

1. lectures
2. videotape
3. personalized student instruction
4. laboratory
5. problem-solving techniques
   a. role-playing
   b. values clarification
   c. case studies
   d. critical incidents
   e. computer assisted simulations
6. fieldwork
   a. internship
   b. field trips
   c. independent study
   d. class projects (surveys, interviews)
   e. in-service training
   f. continuing education
7. resource speakers
8. self-instructional materials

FIGURE 9: Instructional Methods Applicable to Environmental Health

Lectures have traditionally been relied on heavily to transmit knowledge to students. The controlled format enables the instructor to cover subject matter considered to be most important, and at the same time, cover large amounts of information due to the one-way nature of the communication. Normally, questions are encouraged, but some students don't learn as effe tively from lectures as they do from other methods. The degree of student preparation and native intelligence is oftentimes directly correlated to their understanding of the lecture. Slower students may be left behind and advanced students may become bored with the lecture format.

Videotapes are in common use in most universities. A properly prepared videotape can bring new perspectives to a taped lecture with field visits, simulations, music, and color added to hold the students' attention and facilitate understanding. Videotapes are not conducive to questions and answer discussions, however, and do not replace the instructor.

Personalized student instruction (PSI) is a method advocated by Keller, et. al, that fits the mastery learning process.[18] Lectures are minimized, and students work at their own pace utilizing student tutors. Kulik and Jaska reviewed 39 studies comparing conventional and PSI methods and found performance of PSI students to be superior to that of students in conventional classes in 38 of 39 studies.[19] PSI depends on properly prepared self-paced instructional materials which makes it a candidate for the basic science courses in the environmental health curriculum. Some self-paced materials exist in environmental health instruction; one notable example which comes to mind is that prepared by the Center for Disease Control in their "homestudy" program.

Laboratory practice is another long-standing and effective instructional method. It is essential in the basic science courses, particularly biology, chemistry, and physics. Environmental health students require laboratory instruction in their advanced coursework, as well. Sampling procedures, testing, equipment, and analytic methodologies in air, water, food, and the energy media are essential. The emphasis should be in "hands-on" work whenever possible. Student and class research projects are amenable to laboratory work and help to bridge the gap from the classroom to the field.

Problem-solving techniques were identified in our membership surveys as deficient areas in some curricula. This is an essential part of professional practice, and students need experience in these techniques. Role-playing exercises may be of help in exploring behavioral studies such as conflict resolution and behavioral modification. Values clarification can be used as a method to instruct in professional ethics and attributes.

Case studies are another time-honored problem-solving technique. Environmental law courses will rely heavily on this method, but environmental health courses are also increasing in this trend. Situations such as Snow on Cholera, Minimata Bay, the Love Canal, the Kepone incident, and others, offer keys to epidemiology instruction, and also provide valuable insight to the direction of future environmental health activities. The critical incident is a related technique whereby a particular case has been analyzed in detail and transformed into a learning experience.

A final problem-solving technique that is becoming available is the computer assisted simulation.[20] At the present time, few "packaged" products are available to environmental health personnel, but one example is the "PLATO" systems developed at the University of Illinois.[21] Air quality and water quality modeling has advanced to a very sophisticated degree, and is being taught at some institutions.

The next major category of instructional techniques pertain to fieldwork. Many institutions require student internships as integral parts of their curricula. These internships are normally arranged by the faculty, aimed at selected governmental or industrial institutions. If carefully selected,

the internship is a valuable tool to the student not only in gaining the necessary competencies but also in selecting exactly what form of employment to seek.

Field trips are another essential and time-honored method of instruction. Many institutions offer practica or symposia that involve visits to establishments that are inspected by field practitioners. The local environmental health agency can normally assist these field visits. Suggested tours would include: hospitals, food processing plants, dairies, water and sewage treatment plants, industry with occupational health, noise, and air quality control programs, civil or administrative hearings, and many others. Sometimes student independent study or class projects may be tied to these establishments or the community as a whole. Students may research a particular topic or use survey instruments to measure public opinion on an environmental health issue. Field work should be an integral part of any environmental health curriculum.

In-service training and continuing education workshops are a necessary part of the practitioner's continuing competency education. Since the field of environmental health is so dynamic, the information used by the practitioner is likely to become obsolete without continuing education.

A related method is the use of resource or "guest" speakers in the classroom. If carefully selected, and appropriate topics assigned, outside speakers may have a very beneficial effect. If the speaker is a field practitioner, his experience and insights are apt to be valuable to the students. These speakers help bridge the gap from class to field and may provide information on job opportunities and problems as well.

A final instructional method that has been proven useful in environmental health is self-instructional materials. Typically, these contain

text material, study guides or manuals, lesson objectives and lesson examinations. The examinations may or may not be proctored depending on the intent of the course. Self-instruction materials are well suited to mastery learning approaches. These materials have good applicability to continuing education efforts as evidenced by the Center for Disease Control's "Homestudy" program.

All of the above described instructional strategies are either of demonstrated or potential use in the environmental health curriculum. Judicious use of all techniques will complement the competency based education process.

7. Student Appraisals

As in describing approaches to teacher strategies, the competency based approach to student appraisals differs from the more traditional methods. Mastery learning evaluations are designed to test the student repeatedly, if necessary, until he has attained the prescribed mastery level of the knowledge and skill competencies. The student may not move on to new subject areas until he has demonstrated a mastery of the material. As mentioned previously in reference to mastery learning, this system is designed to assure that 75 to 90 percent of the students attain the same level of achievement, as do the top 25 percent under typical group based instructional methods.

Mastery learning, and competency based education in general, rely on a competency based examination for student appraisal. The examination is based on the objectives and indirectly the competencies that have been identified. The examination is scored and grade assigned, not on the normal distribution of student scores (norm-referencing), but on the prede-

termined mastery level of the subject matter. If a 90% mastery level is determined ("A" level), then students will have to score at the "A" level to proceed on to new subject matter. If they fail, they must repeat until the mastery level is attained.

Examinations that are based on competencies and that are scored on the mastery level are termed "criterion-referenced." The proficiency examination and the self-assessment tools for environmental health practitioners presently under development are competency based and criterion referenced. The National Environmental Health Association, as a professional education association organization, is most interested in upgrading the practitioner's level of competency, not the determination of one's score matched against another's score; hence, NEHA's use of criterion-referenced material for continued competency.

Student appraisal methodologies are not limited to terminal examinations. Assessments may be made at the entry, formative (self) and summative (final) levels.[22] The entry assessment is designed to insure that students are placed at a level compatible with learning already achieved and to serve as an aid in recommending remedial or advanced coursework. The formative (self) assessment may be used frequently during a course to guide the student on his or her progress. The formative assessment is wholly non-judgmental; no grade or score is kept by the instructor. The formative assessment prepares the student for the summative or final assessment.

Student assessments are ideally not limited to the typical pencil and paper examinations. Lab practicals requiring the demonstration of knowledge and skills involved in analytical techniques, sampling, testing, and use of equipment are a necessary part of student appraisals. Oral

examinations and evaluations on more abstract topics such as ethics, attributes, and interpersonal skills may also be necessary tools in appraising students in environmental health.

The Profession of Environmental Health

The curriculum guide pinpoints the underlying concepts (KSA's) needed before implementing the practitioner's activities. It is the identified knowledges, skills, and attributes which are necessary prior to practicing sanitarian-type functions. Once mastery of the KSA's is attained, the individual practitioner can perform many different and distinct tasks. The development of the RDI, KSA's, and CG should bring into proper perspective the uniqueness of the career sanitarian, and has provided the foundation that compels recognition as a profession.

The term "profession" has been defined in many ways. According to J. Bickerdicke, the following characteristics make up a learned profession:

> "The term profession can be defined as a recognized body of knowledge whose skills and attributes are served by a group of individuals educated and experienced in those skills. And professional skills are such that they demand knowledge and understanding to perform and cannot be undertaken in a professional manner without the relevant academic and/or professional education and training. Additionally, the members of a profession are normally united under the umbrella of a professional body and the conduct of a profession is clearly recognizable by the confidence, competence, and integrity with which these professional skills are performed." [23]

Our research has been instrumental in formulating and analyzing the elements within the field of environmental health that make up the professional sanitarian. The term "sanitarian" can be defined, according to our research, as one who works in any one, or combination of, the fourteen program areas (see Appendix A), and has mastered the identified knowledges, skills, and attributes (see Appendix C), in order to become a competent

practitioner in today's community.

In summary, the history of the environmental health practitioner ref'ects dynamic progress, from emphasis on regulatory inspections in the 1930's to the multi-dimensional scope of responsibilities attributed to the professional at the present time. Currently, the sanitarian is no longer overshadowed by the physician, engineer, or any other health related professional. It is important, however, to reflect upon the following statement made nearly twenty years ago:

> "No matter what titles we appropriate for our use, what degrees, what licenses we acquire, how hale and hearty we are in exerting our qualifications.....we cannot be accepted as professional men until we act as professional men. Outer pressures will not keep us in our quest for recognition....., but inner development will be our key." [24]

This "inner development" will determine the future direction of environmental health, for the field has grown to new and broader dimensions that challenge each practitioner to help shape the destiny of our world and its people.

Recommendations

Based on this project, the project staff strongly recommends the following to be developed in succession to implement a national credentialing program in environmental health.

1. SELF-ASSESSMENT AND CONTINUED COMPETENCY

The self-assessment instrument is to be a tool to be used by and for any environmental health practitioner to assess his knowledge and skills in the environmental health sciences at all levels and in all areas of practice. This instrument will provide the practitioner with a thorough understanding of his or her deficiencies within the profession. Once these deficiencies have been identified, a continuous educational and/or training program should be readily available to upgrade the competency of the practitioner in the specific areas of deficiency. The National Environmental

Health Association has begun preliminary work to develop continued competency packets.

A checklist sent to 6,000 practitioners surveying the attitudes of the profession indicated a need to develop the following areas: continuing education, interpersonal skills, technical areas, and public relations. We specifically recommend these areas to be included in continuing education programs within the framework of the KSA's. Seventy-eight percent of the practitioners responding to the checklist agreed that continuing education should be mandatory for all practicing sanitarians. As a result, in order to further the competency of individual sanitarians, and to assure the public of optimum health protection, it is imperative that a continuing competency program for the profession be established and funded.

2. NATIONAL PROFICIENCY EXAMINATION

The development of a national proficiency examination, based on established criteria, is necessary for the execution of environmental health services. Passage of this test will permit the individual applicant to be credentialed in his or her profession.

An entry-level generalist proficiency examination will provide the following benefits to both the consumer (public) and to the environmental health practitioner.

(1) a quality assurance mechanism for the consumer by providing a base line competency level throughout the practice

(2) a measurement in assessing further continuing education needs for the practitioner

Once the National Proficiency Examination is developed and accepted by the National Environmental Health Association, the question is who will be qualified to take the examination. Candidates meeting certain requirements will be able to take the examination and can use the Self-Assessment Tool to point out deficiencies prior to taking the proficiency exam. This would assure equal opportunity and candidacy of all competent practitioners.

3. ACCREDITATION OF BACCALAUREATE PROGRAMS IN ENVIRONMENTAL HEALTH

We recommend that the National Accreditation Council for Environmental Health Curriculum move quickly to adopt the Curriculum Guide as the basis for evaluating curricula in the various schools offering baccalaureate and graduate degrees in environmental health. We are specifically hoping that the sixty-three schools that offer a baccalaureate degree will incorporate the guidelines provided in this document into their educational programs.

4. STATE AND INDUSTRY TRAINING PROGRAMS

The National Environmental Health Association is recommending that this Curriculum Guide be provided to all Public Health and Environmental Protection agencies for distribution and use. Moreover, key industries should also receive copies of this document for in-service training.

LIST OF REFERENCES

1. Morgan, Monroe T., Environmental Health Personnel Needed, What Kind and How Many?, Journal of Environmental Health, Vol. 30, No. 4, 1968 pp. 422-425.
2. Krone, Lawrence J., L.T. Worrell, and F.M. Kent, Curriculum Guide for Practitioners in Environmental Health, National Environmental Health Association, Denver, April, 1979, pp. 107-110
3. Krone, Ibid, p. 107-110.
4. May, Bella J., Competency Based Education: General Concepts, Journal of Allied Health, Vol. 8, No. 3, 1979, pp. 166-171
5. May, Ibid, p. 167.
6. Krone, Lawrence J., R.W. Powitz, and L. Worrell, Identification of the Role Performed by the Sanitarian as a Health Professional: Final Report, National Environmental Health Association, Denver, 1978.
7. Mager, Robert F., Preparing Instructional Objectives, Fearlon Publishers, Belmont, CA, 1962, p. 3.
8. National Accreditation Council for Environmental Health Curricula (NACEHC), Accreditation Program for Undergraduate Curricula in Environmental Health, Denver, 1976.
9. Hatlen, Jack B., Undergraduate Education of Sanitarian's Curriculum and Accreditation, Journal of Environmental Health, Vol. 30, No. 4, 1968, pp. 407-411.
10. NACEHC, op. cit, p. 32.
11. personal communication, Jack Conway, Ph.D., Chairman, National Internship Council, October 31, 1979.
12. personal communication, Trenton Davis, Dr., P.H., Chairman of the National Accreditation Council for Environmental Health Curricula, October 31, 1979.
13. Fry, H.G., Education and Manpower for Community Health, University of Pittsburgh Press, Pittsburgh, 1967, pp. 8-9.
14. McGaghie, W.C., Miller, Sajid, and Telder, Competency Based Curriculum Development in Medical Education, An Introduction, WHO Public Health Paper 68, Geneva, 1978.
15. Stamper, John H., Curriculum Development: Assessing Educational Needs, Journal of Allied Health, Vol. 7, No. 1, 1978, pp. 42-48.
16. Sanders, J.R., and Murray, S.L., Alternatives for Achievement Testing, Educational Technology, March, 1976, pp. 17-23.
17. Martin, James A., Mastery Learning, A Model for Allied Health, Journal of Allied Health, Vol. 6, No. 3, 1977, pp. 40-44.
18. Giese, Maurine and Michael Lawler, Development and Implementation of a PSI Course in Human Physiology, Journal of Allied Health, Vol. 7, No. 4, 1978, 268-273.
19. Kulik, J.A. and P. Jaska, PSI and Other Educational Technologies in Teaching, Educational Technology, 17: 12-19, 1977.
20. Pan American Health Organization, A Competency-Based Curriculum for Veterinary Public Health and Preventive Medicine, Scientific Publication No. 313, Washington, D.C., 1975.
21. Grimes, G.M., Handbook for Veterinary Faculty Use of the PLATO System. CERL Report X-39, University of Illinois, 1973.
22. McGaghie, op. cit, p. 69-79.
23. Bickerdike, J., The Profession, Professionalism and the Way Ahead: A Personal View, Environmental Health Review, 22 (2), 1978, pp. 32 - 35.
24. Kimsey, W.W., President's Message, The Sanitarian, 22 (4), 1960, p. 193.

PROJECT DIRECTOR'S DISCUSSION OF PROBLEMS AND SOLUTIONS

There were several minor problems which require explanation in the hope that future project personnel shall be able to avoid problems. Probably the most frustrating problem was the lack of response from those contacted. The KSA checklist returns from practitioners were low, and the response from faculty members of schools offering environmental health curricula was even poorer. Even reminder telephone calls to state training officers went unheeded by many, and the actual return of information was appalling. In order to receive substantial returns for an inquiry, a considerable amount of time involved in follow-up was required, such as letters, telephone calls, NEHA newsletter, and personal contacts. Future personnel working on projects should be cognizant of the extra time they will have to spend getting information, and schedule their work accordingly.

Secondly, much more time was needed to develop the KSA's than originally allocated, hence the request for an extension of time. Only four months was allocated to develop the KSA blueprint for the curriculum guide, when in reality the KSA's took more than eight months to complete. The development of the KSA's required the use of many of the environmental health texts in the National Environmental Health Association's library, followed by input from consultants, work groups, hundreds of practitioners, and the staff. None of the work on the entire project required as much thought, discussion, research, and rewrite as did the KSA blueprint. This monumental work took many weeks to determine how the content of fourteen program areas might be crossed, and yet produce the fundamental knowledges and skills. In retrospect, the project staff discovered that the profession of the sanitarian has five basic building blocks from which all activities

can be derived. These same five knowledges make up the uniqueness of the sanitarian's profession.

In closing, this particular report includes the most comprehensive study to date on the competency-based environmental health curriculum, and it should be made available to everyone sincerely interested in promoting knowledge and skill competencies in environmental health.

APPENDIX A

FOURTEEN PROGRAM AREAS

Program Area Goals for Environmental Health:

1. Air Pollution Control: To assure a community air resource conducive to positive human health, which does not injure our environment and is aesthetically desirable

2. Food Protection: To assure safe, wholesome, and sanitary food and food products wherever produced, processed, distributed, transported, or served

3. Hazardous Substances and Product Safety: To assure protection from unhealthful or unsafe substances or products

4. Housing (Shelter): To assure adequate, safe, and healthful housing for all persons

5. Institutional Environmental Control: To assure that institutions such as hospitals, schools, nurseries, and penal institutions are operated so as to prevent health and safety problems

6. Land Use: To assure that land resources are planned and utilized in such a manner that will prevent health and safety problems for this and future generations

7. Noise Control: To protect the public from or prevent hazardous or annoying noise levels in residential, business, industrial, or recreation areas and structures

8. Occupational Health and Safety: To assure the positive health and safety of workers in places of employment through controlling hazardous environmental factors

9. Radiation Safety: To prevent unnecessary or hazardous exposure to any types of radiation

10. Recreational Areas and Waters: To assure that recreational and swimming areas are designed and maintained so as to prevent health and safety problems

11. Solid Waste Management: To assure that all solid wastes are managed so as not to create environmental health or aesthetic problems

12. Vector Control: To control insects, rodents, and other animals which adversely affect man's health, safety, and comfort

13. Water Pollution Control: To restore or maintain the quality of water resources by the treatment or prevention of polluted water

14. Water Supply: To assure the provision and maintenance of water supplies which are safe and adequate in quantity and quality

APPENDIX B

ROLE DELINEATION INSTRUMENT

FINAL ROLE DELINEATION REFINEMENT

AND VERIFICATION INSTRUMENT

Section H

1. Position #1
2. Position #2
3. Position #3 — Administrative
   Position #3 — Technical

Position #1

The practitioner performs inspections, field sampling and testing, engages in enforcement, and public information activities.

The Major and Specific Responsibilities for Position #1 are delineated as follows:

MAJOR RESPONSIBILITIES

I. Conducts routine environmental health inspections

Specific Responsibilities:

A. Establishes cooperative relations with people contacted
   1. Makes proper introduction to parties involved
   2. Explains general objectives of inspection
   3. Answers questions clearly

B. Conducts routine inspectional activities
   1. Observes and records general conditions present
   2. Identifies deficiencies and violations
   3. Conducts basic tests and calculations
   4. Interviews persons on-site for additional information

C. Evaluates inspection findings according to uniform departmental procedures
   1. Prepares documentation regarding the situation observed
   2. Identifies environmental health standards, codes, and regulations that are applicable
   3. Requests technical expertise for special problems encountered

D. Submits findings and recommendations to supervisor
   1. Explains violations, regulations, or other problems to concerned parties
   2. Requests compliance or corrective measures other than legal closure to be taken
   3. Compiles and submits detailed report of findings to supervisor
   4. Testifies as an expert witness in court

II. Authorizes issuance of permits and licenses

A. Reviews and takes action on environmental health permits, licenses
   1. Determines compliance according to regulations, standards, and codes
   2. Grants issuance of permit or license if approval is appropriate

III. Collects samples and specimens for laboratory analysis
- A. Locates designated sampling site geographically
  1. Uses maps, graphs, and other geographical information
  2. Identifies sampling site
- B. Explains purpose of sample collection to concerned parties
  1. Describes methods for collecting sample or specimen
  2. Answers questions regarding sampling
- C. Carries out collection procedures for sample or specimen
  1. Identifies the sample or specimen to be taken
  2. Utilizes the necessary equipment in conducting sampling procedures
  3. Collects and transfers sample or specimen to container
- D. Obtains pertinent information regarding sample or specimen and designated site
  1. Labels all specimens and samples collected with name, location, time and date
  2. Observes and records conditions regarding sampling site or collected items
  3. Makes interpretations regarding the environmental health implications of observed situation
- E. Communicates findings to supervisory personnel
  1. Discusses findings with concerned parties
  2. Records pertinent information in writing for further evaluation
- F. Arranges safe transportation of collected sample or specimen to laboratory
  1. Preserves, protects, and insures legal integrity of sample or specimen collected

IV. Performs routine field tests
- A. Provides simple explanation of test to others
  1. Describes objectives and methods for performing test to concerned parties
  2. Answers questions to best of ability
- B. Sets up testing equipment
  1. Prepares testing apparatus for operation
- C. Performs field testing procedures
  1. Performs testing activities in proper sequence
  2. Conducts basic measurements and calculations
- D. Reports field testing results
  1. Records observations, basic calculations, and test readings
  2. Records specific conditions that influence test
  3. Makes limited interpretations regarding environmental health implications of conducted test
  4. Communicates findings to appropriate parties
- E. Adjusts and calibrates test equipment
  1. Conducts routine maintenance checks of test equipment
  2. Makes limited repairs

V. Communicates environmental health information to others
- A. Distributes educational pamphlets, brochures, and booklets to the public
  1. Aids in locating resources for obtaining educational materials
  2. Procures requested information items
- B. Utilizes written communications to convey information
  1. Completes checklist and survey forms
  2. Writes detailed reports in an accurate, coherent style

VI. Plans and implements environmental health investigations

A. Determines nature and scope of environmental health problem to be investigated
   1. Collects and evaluates background information
   2. Delineates casual relationships

B. Conducts environmental health field investigations
   1. Utilizes procedural methodology for conducting investigation
   2. Aids in coordinating investigative efforts with other agencies

C. Initiates environmental health investigations
   1. Assigns or conducts appropriate inspections and surveys
   2. Maintains open communications with those involved in investigation

D. Makes analysis of problem situation
   1. Analyzes and correlates background information with on-site data
   2. With the assistance of legal staff interpret investigative findings with regards to applicable statutes, codes, and regulations

E. Initiates enforcement proceedings
   1. Recommends corrective measures to be taken
   2. Plans for follow-up inspections to assure compliance
   3. Suggests further legal action against violators to Advisory Staff
   4. Testifies as an expert witness in court.

VII. Reviews and evaluates documents, licensure applications, and planning specifications
A. Examines documents, licensure applications, and planning specifications
   1. Checks items for completeness, accuracy, and style
   2. Determines degree of compliance with statutes, standards, and regulations

B. Compiles and submits opinions and recommendations
   1. Suggests modifications and revisions needed
   2. Documents recommendations with supportive data
   3. Submits completed evaluations and recommendations in written form

VIII. Represents department favorably to the public

A. Demonstrates a sensitivity to people and their needs
   1. Manifests a desire to help and not punish; advise and not order
   2. Deals fairly with all societal elements, regardless of race, color, creed, sex or age

B. Utilizes oral communications in dealing with others
   1. Addresses people contacted in a business-like manner
   2. Explains and cites environmental health regulations and codes in language understandable to others
   3. Suggests corrective actions to violators in a factual manner
   4. Uses the phone correctly in handling requests, complaints, and messages

C. Interviews persons to obtain specific information about environmental health problems
   1. Establishes a feeling of mutual cooperation and trust
   2. Utilizes proper questioning techniques
   3. Listens to and records respondent's information with awareness and sensitivity

D. Handles highly-sensitive complaints, inquiries and emergencies
   1. Discusses sensitive situation with concerned party in a diplomatic and positive manner
   2. Explains technical information concerning problem or violation concisely
   3. Suggests viable alternative or appropriate action to be taken to resolve matter

IX. Works productively with other staff members

A. Cooperates with other staff members in conducting work activities
   1. Sets own objectives in conjunction with uniform departmental objectives
   2. Provides suggestions and support for fellow staff in course of work
   3. Accepts constructive criticism in an effort to improve job effectiveness

B. Participates in departmental staff functions
   1. Attends departmental meetings and workshops
   2. Shares ideas in discussions on department problems

Position #2

The practitioner performs educational, investigative, consultative, enforcement, and planning activities.

The Major and Specific Responsibilities for Position #2 are delineated as follows:

MAJOR RESPONSIBILITIES

I. Communicates environmental health information to others

Specific Responsibilities:

A. Distributes educational pamphlets, brochures, and booklets to the public
   1. Aids in locating resources for obtaining educational materials
   2. Procures requested information items

B. Utilizes written communications to convey information
   1. Completes checklist and survey forms
   2. Writes detailed reports in an accurate, coherent style

II. Organizes environmental health investigations

A. Determines nature and scope of environmental health problem to be investigated
   1. Collects and evaluates background information
   2. Delineates casual relationships

B. Conducts environmental health field investigations
   1. Utilizes procedural methodology for conducting investigation
   2. Aids in coordinating investigative efforts with other agencies

C. Initiates environmental health investigations
   1. Assigns or conducts appropriate inspections and surveys
   2. Maintains open communications with those involved in investigation

D. Makes analysis of problem situation
   1. Analyzes and correlates background information with on-site data
   2. With the assistance of legal staff interpret investigative findings with regards to applicable statutes, codes, and regulations

E. Initiates enforcement proceedings
   1. Recommends corrective measures to be taken
   2. Plans for follow-up inspections to assure compliance
   3. Suggests further legal action against violators to Advisory Staff
   4. Testifies as an expert witness in court

III. Provides consultative services relating to environmental health problems

A. Locates and utilizes information resources
   1. Compiles and reviews reports, literature, and statistical data
   2. Obtains additional information from special resource individuals

B. Evaluates information compiled with reference to environmental health problems
   1. Interprets and analyzes findings in relation to problem
   2. Suggests methods and means for solving problem

C. Proposes conclusions and recommendations to supervisor, orally and in writing
   1. Presents overview reflecting scope of problem to consultee
   2. Substantiates conclusions given with relevant documentation
   3. Provides feasible alternatives for dealing with problem

D. Motivates decision-making process
   1. Communicates ideas and information with confidence and objectivity
   2. Encourages implementation of proposed recommendations
   3. Obtains results without causing undue anxiety

IV. Conducts routine environmental health inspections

A. Establishes cooperative relations with people contacted
   1. Makes proper introduction to parties involved
   2. Explains general objectives of inspection
   3. Answers questions clearly

B. Conducts routine inspectional activities
   1. Observes and records general conditions present
   2. Identifies deficiencies and violations
   3. Conducts basic tests and calculations
   4. Interviews persons on-site for additional information

C. Evaluates inspection findings according to uniform departmental procedures
   1. Prepares documentation regarding the situation observed
   2. Identifies environmental health standards, codes, and regulations that are applicable
   3. Requests technical expertise for special problems encountered

D. Submits findings and recommendations to supervisor
   1. Explains violations, regulations, or other problems to concerned parties
   2. Requests compliance or corrective measures other than legal closure to be taken
   3. Compiles and submits detailed report of findings to supervisor
   4. Testifies as an expert witness in court

V. Supervises staff activities

A. Selects qualified personnel
   1. Interviews applicants for position openings
   2. Complies with established employment guidelines
   3. Projects manpower staffing needs

B. Directs and supervises staff training activities
   1. Directs or delegates implementation of on-job training programs
   2. Initiates continuing education programs for staff
   3. Develops policy and procedure manuals for agency

C. Provides evaluative consultations with staff members
   1. Discusses positive and negative aspects of job performance with staff members
   2. Provides career guidance to employees
   3. Utilizes competency assurance measures
   4. Takes appropriate disciplinary action

D. Motivates staff members to improve work
   1. Encourages practitioners to utilize self-assessment techniques
   2. Encourages staff suggestions, constructive criticism, and creative innovations
   3. Provides positive reinforcement for jobs well done

VI. Participates in planning and development environmental health program activities

A. Assists in determining the nature and dimensions of environmental health problems within a community
   1. Defines, quantifies, and ranks environmental health problems within an area
   2. Aids in evaluating adequacy of current environmental programs to meet needs

B. Assists in the development of proposals for program activities
   1. Incorporates the goals and mission of agency into proposed program
   2. Aids in devising program methods and procedures to meet stated needs
   3. Identifies resources and equipment needed for program implementation
   4. Provides budgetary information in program area
   5. Recommends measureable objectives for both program and self-assessment

C. Submits for approval program proposal for implementation
   1. Compiles reports and documents substantiating program proposal
   2. Recommends evaluation methods to assure effective progress of program activities
   3. Explains and promotes implementation of proposed program activities

VII. Reviews and evaluates documents, licensure applications, and planning specifications

A. Examines documents, licensure applications, and planning specifications
   1. Checks items for completeness, accuracy, and style
   2. Determines degree of compliance with statutes, standards, and regulations

B. Compiles and submits opinions and recommendations
   1. Suggests modifications and revisions needed
   2. Documents recommendations with supportive data
   3. Submits completed evaluations and recommendations in written form

VIII. Represents department favorably to the public

A. Demonstrates a sensitivity to people and their needs
   1. Manifests a desire to help and not punish; advise and not order
   2. Deals fairly with all societal elements, regardless of race, color, creed, sex, or age

B. Utilizes oral communications in dealing with others
   1. Addresses people contacted in a business-like manner
   2. Explains and cites environmental health regulations and codes in language understandable to others
   3. Suggests corrective actions to violators in a factual manner
   4. Uses the phone correctly in handling requests, complaints, and messages

C. Interviews persons to obtain specific information about environmental health problems
   1. Establishes a feeling of mutual cooperation and trust
   2. Utilizes proper questioning techniques
   3. Listens to and records respondent's information with awareness and sensitivity

D. Handles highly-sensitive complaints, inquiries and emergencies
   1. Discusses sensitive situation with concerned party in a diplomatic and positive manner
   2. Explains technical information concerning problem or violation concisely
   3. Suggests viable alternative or appropriate action to be taken to resolve matter

IX. Serves as official representative of agency

A. Participates in meetings and conference held with business leaders, unions, civic groups, professional groups, or others
   1. Explains agency's official position on environmental health concerns
   2. Provides current information to others on relevant topics

X. Works productively with other staff members

A. Cooperates with other staff members in conducting work activities
   1. Sets own objectives in conjunction with uniform departmental objectives
   2. Provides suggestions and support for fellow staff in course of work
   3. Accepts constructive criticism in an effort to improve job effectiveness

B. Participates in departmental staff functions
   1. Attends departmental meetings and workshops
   2. Shares ideas in discussions on department problems

C. Motivates decision-making process
   1. Communicates ideas and information with confidence and objectivity
   2. Encourages implementation of proposed recommendations
   3. Obtains results without causing undue anxiety

Position #3 — Administrative

The practitioner performs supervisory, administrative and planning activities; directs enforcement and investigative programs.

The Major and Specific Responsibilities for Position #3 — Administrative are delineated as follows:

MAJOR RESPONSIBILITIES

I. Participates in planning and development environmental health program activities

Specific Responsibilities:

A. Directs activities in determing the nature and dimensions of environmental health problems within a community
   1. Defines, quantifies, and ranks environmental health problems within an area
   2. Evaluates adequacy of current environmental programs to meet needs

B. Directs activities in the development of proposals for program activities
   1. Incorporates the goals and mission of agency into proposed program
   2. Devises program methods and procedures to meet stated needs
   3. Identifies resources and equipment needed for program implementation
   4. Provides budgetary information in program area
   5. Recommends measureable objectives for both program and self-assessment

C. Submits for approval program proposal for implementation
   1. Compiles substantiating reports and documents
   2. Recommends evaluation methods to assure effective progress of program activities
   3. Explains and promotes implementation of proposed program activities

II. Reviews and evaluates documents, licensure applications, and planning specifications

A. Examines documents, licensure applications, and planning specifications
   1. Checks items for completeness, accuracy, and style
   2. Determines degree of compliance with statutes, standards, and regulations

B. Compiles and submits opinions and recommendations
   1. Suggests modifications and revisions needed
   2. Documents recommendations with supportive data
   3. Submits completed evaluations and recommendations in written form

III. Conducts liaison activities with other agencies and groups

A. Facilitates communications with other agencies or groups
   1. Demonstrates leadership abilities in working with others
   2. Motivates and encourages others to work for needed changes

B. Exchanges information with other agencies, industries or community representatives through proper protocol
   1. Shares ideas on current methods and techniques for handling problems
   2. Collaborates with others in providing needed services

IV. Plans and directs environmental health programs
   A. Develops goals, mission, and objectives for agency
      1. Assess environmental health status and needs of community
      2. Reviews staff recommendations regarding program adequacy
      3. Considers agency and community limitations on tools and resources needed for program

   B. Directs implementation of program activities
      1. Develops and allocates resources, including manpower, finances, time, equipment and facilities
      2. Establishes policy and procedures for program activities
      3. Delegates and assumes responsibilities for program implementation
      4. Coordinates activities with agency goals and objectives

   C. Evaluates program on a periodic basis
      1. Assesses program effectiveness and efficiency
      2. Holds staff meetings to discuss program evaluation
      3. Re-directs program efforts and activities as necessary

V. Oversees enforcement proceedings in connection with environmental health violations

   A. Directs agency action to be taken against violating source
      1. Reviews staff reports, recommendations, and actions
      2. Determines applicability of statutes, codes, and regulations
      3. Authorizes issuance of citations or directives for compliance

   B. Participates in legal action against violators
      1. Schedules and conducts administrative hearings
      2. Reviews and evaluates prepared drafts of legal cases as technical assistance to legal counsel

VI. Supervises staff activities

   A. Selects qualified personnel
      1. Interview applicants for position openings
      2. Complies with established employment guidelines
      3. Projects manpower staffing needs

   B. Directs and supervises staff training activities
      1. Directs or delegates implementation of on-job training programs
      2. Initiates continuing education programs for staff
      3. Develops policy and procedure manuals for agency

   C. Provides evaluative consultations with staff members
      1. Discusses positive and negative aspects of job performance with staff members
      2. Provides career guidance to employees
      3. Utilizes competency assurance measures
      4. Takes appropriate disciplinary action

VII. Communicates environmental health information to others

   A. Distributes educational pamphlets, brochures, and booklets to the public
      1. Aids in locating resources for obtaining educational materials
      2. Procures requested information items

   B. Utilizes written communications to convey information
      1. Completes checklist and survey forms
      2. Writes detailed reports in an accurate, coherent style

   C. Provides and reviews factual information to news media
      1. Writes news releases

VIII. Organizes environmental health investigations

A. Determines nature and scope of environmental health problem to be investigated
   1. Collects and evaluates background information
   2. Delineates causal relationships

B. Conducts environmental health field investigations
   1. Utilizes procedural methodology for conducting investigation
   2. Coordinates investigative efforts with other agencies

C. Initiates environmental health investigations
   1. Assigns or conducts appropriate inspections and surveys
   2. Maintains open communications with those involved in investigation

D. Makes analysis of problem situation
   1. Analyzes and correlates background information with on-site data
   2. With the assistance of legal staff interpret investigative findings with regard to applicable statues, codes, and regulations

E. Initiates enforcement proceedings
   1. Recommends corrective measures to be taken
   2. Plans for follow-up inspections to assure compliance
   3. Suggests further legal action against violators to Advisory Staff
   4. Testifies as an expert witness in court

IX. Provides consultative services relating to environmental health problems

A. Locates and utilizes information resources
   1. Compiles and reviews reports, literature, and statistical data
   2. Obtains additional information from special resource individuals

B. Evaluates information compiled with reference to environmental health problems
   1. Interprets and analyzes findings in relation to problem
   2. Suggests methods and means for solving problem

C. Proposes conclusion and recommendations to supervisor, orally and in writing
   1. Presents overview reflecting scope of problem
   2. Substantiates conclusions given with relevant documentation
   3. Provides feasible alternatives for dealing with problem

X. Conducts meetings and conferences

A. Directs discussion sessions
   1. Maintains order of meetings or conferences
   2. Assures proper scheduling in accordance with agenda

XI. Represents department favorably to the public

A. Demonstrates a sensitivity to people and their needs
   1. Manifests a desire to help and not punish; advise and not order
   2. Deals fairly with all societal elements, regardless of race, color, creed, sex or age

B. Utilizes oral communications in dealing with others
   1. Addresses people contacted in a business-like manner
   2. Explains and cites environmental health regulations and codes in language understandable to others
   3. Suggests corrective actions to violators in a factual manner
   4. Uses the phone correctly in handling requests, complaints, and messages

C. Interviews persons to obtain specific information about environmental health problems
   1. Establishes a feeling of mutual cooperation and trust
   2. Utilizes proper questioning techniques
   3. Listens to and records respondent's information with awareness and sensitivity

D. Handles highly-sensitive complaints, inquiries and emergencies
   1. Discusses sensitive situation with concerned party in a diplomatic and positive manner
   2. Explains technical information concerning problem or violation concisely
   3. Suggests viable alternative or appropriate action to be taken to resolve matter

XII. Serves as official representative of agency

A. Participates in meetings and conferences held with business leaders, unions, civic groups, professional groups or others
   1. Explains agency's official position on environmental health concerns
   2. Provides current information to others on relevant topics

B. Facilitates group interaction
   1. Motivates inter-communication between parties
   2. Utilizes group-dynamics techniques

C. Motivates decision-making process
   1. Communicates ideas and information with confidence and objectivity
   2. Encourages implementation of proposed recommendations
   3. Obtains results without causing undue anxiety

D. Motivates staff members to improve work
   1. Encourages practitioners to utilize self-assessment techniques
   2. Encourages staff suggestions, constructive criticism, and creative innovations
   3. Provides positive reinforcement for jobs well done

Position #3 — Technical

The practitioner directs educational and investigative programs; acts a- a consultant to industry and governmental agencies; and demonstrates administrative ability in environmental management.

The Major and Specific Responsibilities for Position #3 — Technical are delineated as follows:

MAJOR RESPONSIBILITIES

I. Organizes environmental health investigations
   A. Determines nature and scope of environmental health problem to be investigated
      1. Collects and evaluates background information
      2. Delineates causal relationships

   B. Conducts environmental health field investigations
      1. Utilizes procedural methodology for conducting investigation
      2. Aids in coordinating investigative efforts with other agencies

   C. Initiates environmental health investigations
      1. Assigns or conducts appropriate inspections and surveys
      2. Maintains open communications with those involved in investigation

   D. Makes analysis of problem situation
      1. Analyzes and correlates background information with on-site data
      2. With the assistance of legal staff interpret investigative findings with regards to applicable statutes, codes and regulations

   E. Initiates enforcement proceedings
      1. Recommends corrective measures to be taken
      2. Plans for follow-up inspections to assure compliance
      3. Suggests further legal action against violators to Advisory Staff
      4. Testifies as an expert witness in court

II. Provides consultative services relating to environmental health problems

A. Locates and utilizes information resources
1. Compiles and reviews reports, literature, and statistical data
2. Obtains additional information from special resource individuals

B. Evaluates information compiled with reference to environmental health problems
1. Interprets and analyzes findings in relation to problem
2. Suggests methods and means for solving problem

C. Proposes conclusions and recommendations orally and in writing
1. Presents overview reflecting scope of problem to consultee
2. Substantiates conclusions given with relevant documentation
3. Provides feasible alternatives for dealing with problem

III. Participates in planning and development of environmental health program activities

A. Directs activities in determining the nature and dimensions of environmental health problems within a community
1. Defines, quantifies, and ranks environmental health problems within an area
2. Evaluates adequacy of current environmental health programs to meet needs

B. Directs activities in the development of proposals for program activities
1. Incorporates the goals and mission of agency into proposed program
2. Devises program methods and procedures to meet stated needs
3. Identifies resources and equipment needed for program implementation
4. Provides budgetary information in program area
5. Recommends measureable objectives for both program and self-assessment

C. Submits for approval program proposal for implementation
1. Compiles substantiating reports and documents
2. Recommends evaluation methods to assure effective progress of program activities
3. Explains and promotes implementation of proposed program activities

D. Plans, compiles and analyzes environmental impact statement documents

IV. Plans and directs environmental health programs

A. Develops goals, mission, and objectives for agency
1. Assess environmental health status and needs of community
2. Reviews staff recommendations regarding program adequacy
3. Considers agency and community limitations on tools and resources needed for program

B. Directs implementation of program activities
1. Develops and allocates resources, including manpower, finances, time, equipment and facilities
2. Establishes policy and procedures for program activities
3. Delegates and assumes responsibilities for program implementation
4. Coordinates activities with agency goals and objectives

C. Evaluates program on a periodic basis
1. Assesses program effectiveness and efficiency
2. Holds staff meetings to discuss program evaluation
3. Re-directs program efforts and activities as necessary

V. Conducts liaison activities with other agencies and groups

A. Facilitates communications with other agencies or groups
1. Demonstrates leadership abilities in working with others
2. Motivates and encourages others to work for needed changes

B. Exchanges information with other agencies, industries or community representatives through proper protocol
1. Shares ideas on current methods and techniques for handling problems
2. Collaborates with others in providing needed services

VI. Communicates environmental health information to others

A. Distributes educational pamphlets, brochures, and booklets to the public
   1. Aids in locating resources for obtaining educational materials
   2. Procures requested information items

B. Utilizes written communications to convey information
   1. Completes checklist and survey forms
   2. Writes detailed reports in an accurate, coherent style

C. Provides and reviews factual information to news media
   1. Writes news releases

APPENDIX C

BLUEPRINT OF THE KNOWLEDGES, SKILLS AND ATTRIBUTES OF ENVIRONMENTAL HEALTH PRACTITIONERS

BLUEPRINT OF THE KNOWLEDGES, SKILLS AND ATTRIBUTES FOR ENVIRONMENTAL HEALTH PRACTITIONERS

National Environmental Health Association
1200 Lincoln, Suite #704
Denver, Colorado 80203

The research for this document was funded by the U.S. Dept. of Health, Education & Welfare under contract #HRA 231-77-0030.

The knowledge of disease and injury causation and control techniques requires an initial body of recall knowledge before skills can be applied. Therefore you will not find skills listed until page 13. Thereafter knowledges are listed on left hand pages with required skills on right hand pages. Indented skills indicate greater specificity. (A) indicates attributes needed in the profession.

KNOWLEDGES

I. KNOWLEDGE OF DISEASE AND INJURY CAUSATION AND CONTROL TECHNIQUES

A. Knowledge of Disease and Injury Causation

1. Knowledge of acute disease causation

a. Knowledge of agent factors

(1) Knowledge of the types of reservoirs involved in ill health

(a) human

1) clinical cases

2) carriers (asymptomatic)

(b) animal

(c) inanimate (free living in soil or water)

(d) plant

(2) Knowledge of etiological agents and resultant diseases

(a) Biological factors

1) Microorganisms

a) Viruses

1. Arboviruses

a. Equine encephalitides

1. Mode of transmission, *Culex* species
2. Reservoir probably birds, small rodents and reptile and amphibian
3. Incubation period: 5-15 days
4. Symptoms - affects brain, spinal cord and meninges; high fever, stupor, spasiticity, tremors

b. Colorado tick fever

1. Mode of transmission: *Dermacentor andersoni*
2. Reservoir - small mammals
3. Incubation period: 4-5 days
4. Symptoms: acute fever, remission and recurrence lasting 2-3 days

c. Yellow fever

1. Mode of transmission: *Aedes aegypti*
2. Reservoir: man, *Aedes aegypti*, monkeys
3. Incubation period: 3-6 days
4. Symptoms: sudden fever onset, headache, nausea, vomiting, jaundice

2. Infectious hepatitis

a. Mode of transmission through contact, water, milk and food

b. Reservoir is man

c. Incubation period: 15-50 days, commonly 25

d. Symptoms: fever, nausea, abdominal pain, jaundice, necrosis of liver

3. Poliomyelitis

a. Mode of transmission: oral contact, milk

b. Reservoir is man

c. Incubation period: 7-12 days; ranging to 3-21

d. Symptoms: fever, headache, gastrointestinal disturbance, stiffness of neck and back with or without paralysis

4. Rabies

a. Mode of transmission: bite of rabid animal; airborne spread from bats to man in caves with many bats

b. Reservoir: small carnivores including bats

c. Incubation period: 4-6 weeks

d. Symptoms, almost always fatal form of encephalitis; headache, fever, paralysis

HOW TO USE THIS DOCUMENT

This document is constructed in a manner so as to describe important knowledges on the left page; whereas the skills and attributes pertinent to a given knowledge are listed on the right page directly opposite the relevant knowledge cluster.

In the case of certain strictly recall knowledges, (especially regarding disease causation), skills and attributes are not pertinent. Here the knowledges continue on the right and left pages until skill/attribute clusters have again been identified.

The knowledges, skills and attributes presented here are based on the functions and major responsibilities of environmental health practitioners as described in the Role Delineation Instrument (RDI). For a discussion on how the knowledge and skill competencies relate to the role functions, see the attached Curriculum Guideline.

The Blueprint contains a weighting scheme which enables one to place the knowledge and skill competencies into perspective. This weighting scheme was designed for the self-assessment tools, proficiency examination, and continuing education efforts funded by the Bureau of Health Manpower. This same weighting scheme may be of interest for schools with environmental health curricula designed to prepare students as entry-level environmental health practitioners. The weighted blueprint utilized in these projects is shown below:

WEIGHTED BLUEPRINT

Short KSA Title	RDI Position #1 Weight (%)	RDI Position #2 Weight (%)
I. Disease & Injury Causation & Control		
A. Disease & Injury Causation	16.1	14.1
B. Control & Prevention	20.6	12.5
	36.7	26.6
II. Administrative Law and Process		
A. Lawful Authority & Delegation	2.5	3.0
B. Agency Acquisition of Information	2.3	3.0
C. Agency Administrative Actions	2.5	3.0
D. Enforcing Environmental Health Laws	2.3	3.0
E. Personal & Agency Liability	2.1	2.8
F. Legal Resources	.4	2.4
G. Federal Laws	.8	1.8
	13.0	19.0

WEIGHTED BLUEPRINT
(continued)

	RDI Position #1 Weight (%)	RDI Position #2 Weight (%)
III. Technical Data		
A. Acquisition Environmental Health Data	7.4	5.0
B. Utilization Environmental Health Data	5.8	5.4
C. Quantitative Methods	5.8	4.7
	19.0	15.1
IV. Environmental Health Administration		
A. Organizations	5.7	6.7
B. Management Principles	0.5	5.2
C. Program Planning & Evaluation	0.5	4.8
	6.7	16.7
V. Behavioral Sciences		
A. Human Needs	5.0	6.3
B. Interpersonal Communications	10.0	7.6
C. Group Communications	10.0	7.6
	25.0	21.5

The National Environmental Health Association recognizes that this is an initial effort requiring regular revision. For this reason, your comments and suggestions on improving the document are solicited.

b) Bacteria
1. Order Pseudomonadales
   a. *Vibrio cholerae* (Cholera)
      1. Mode of transmission: water, food (fecal-oral)
      2. Reservoir: man
      3. Incubation period: 2-3 days average
      4. Symptoms: sudden onset of vomiting, profuse watery diarrhea, dehydration and collapse
   b. *Vibrio parahemolyticus*
      1. Mode of transmission: contamination of raw foods of marine origin
      2. Reservoir: seawater, marine life
      3. Incubation period: 2-48 hours; usually 12 hours
      4. Symptoms: abdominal pain, diarrhea, nausea, vomiting, fever
2. Order Chlamydobacteriales
   a. *Psittacosis chlamydia* (Psitticosis/Ornithosis)
      1. Mode of transmission: direct contact with infected birds
      2. Reservoir: parakeets, parrots, pigeons and other birds
      3. Incubation period: 4-15 days
      4. Symptoms: fever, headache and early pneumonic involvement
3. Order: Eubacterides
   a. *Salmonellae* (Salmonellosis)
      1. Mode of transmission: foods, especially meat pies, poultry, dairy products
      2. Reservoir: man, domestic and wild animals
      3. Incubation period: 12-24 hours average
      4. Symptoms: acute infection with sudden abdominal pain, diarrhea, vomiting and fever
      5. Agent: more than 800 serotypes

   b. *Salmonella Typhi* (Typhoid Fever)
      1. Mode of transmission: direct or indirect contact with patient or carrier; raw fruits, vegetables, dairy products, shellfish and water
      2. Reservoir: man, including carriers
      3. Incubation period: average of 2 weeks
      4. Symptoms: continued fever, slow pulse, ulceration of Peyer's patches, rose spots on trunk; constipation
   c. *Shigella* (Shigellosis)
      1. Mode of transmission: objects of food contaminated with feces
      2. Reservoir: man
      3. Incubation period: 1-7 days; usually less than 4
      4. Symptoms: diarrhea, fever, cramps, vomiting
   d. *Yersinia pestis* (Plague)
      1. Mode of transmission: bite of an infective rat flea or contact or airborne route from infected persons
      2. Reservoir: wild rodents, rats
      3. Incubation period: 2-6 days
      4. Symptoms: high fever, fall in blood pressure, rapid pulse, convulsions, coma
      5. Types: bubonic: lymph nodes swollen forming characteristic bubols. Pneumonic is transmitted through respiratory droplets and is more fulminating and dangerous
   e. *Francisella tularensis* (Tularemia)
      1. Mode of transmission: innoculation of skin or conjunctive through handling of infected animals or through bite of deerfly or tick
      2. Reservoir: numerous wild animals
      3. Incubation period: 1-10 days; usually 3
      4. Symptoms: chills and fever, ulcer at site of infection, swollen lymph nodes

f. *Brucellae* (Brucellosis, Undulant fever)
   1. Mode of transmission: contact with infected animals, especially milk or dairy products
   2. Reservoir: cattle, swine, sheep, goats and horses
   3. Incubation period: 5-21 days; highly variable
   4. Symptoms: irregular fever, chills, headache; may become chronic over several years
   5. Other: milk ring test of raw milk is inoculated with stained brucella antigen which agglutinates and forms blue ring at top

g. *Staphylococcus aureus*
   1. Mode of transmission: direct contact with infected person or indirectly through goods
   2. Reservoir: man including subclinical carriers
   3. Incubation period: food poisoning 1-6 hours
   4. Symptoms: abrupt severe nausea, cramps, vomiting and diarrhea; no fever
   5. Other organism forms enterotoxin in potentially hazardous foods. Coagulase (+) characteristic; toxin is heat stable; *Staphylococcus aureus* also is an important hospital and nursery pathogen; bovine mastitis

h. *Streptococcus pyrogenes*
   1. Mode of transmission: direct contact airborne droplet spread or contaminated food and milk
   2. Reservoir: man including carriers
   3. Incubation period: 1-3 days
   4. Symptoms: sore throat with other possible complications
   5. Other: bovine mastitis & consequent transfer to milk

i. *Bacillus anthracis* (Anthrax)
   1. Mode of transmission: contact with animal tissues including hide and hair products
   2. Reservoir: cattle, sheep, goats, horses, pigs and others
   3. Incubation period: Less than 4 days, average
   4. Symptoms: skin lesions progressing to tissues; inhalation anthrax begins like upper respiratory infection followed by fever and shock in 3-5 days and death shortly thereafter. Inhalation and gastrointestinal anthrax are highly fatal, but rare.

j. *Clostridium botulinum* (Botulism)
   1. Mode of transmission: food, especially inadequately canned or processed, then eaten without cooking
   2. Reservoir: soil and intestinal tract of animals
   3. Incubation period: 12-36 hours
   4. Symptoms: highly fatal, afebrile intoxication; weakness, dizziness, doublevision; death from respiratory or cardiac failure

k. *Clostridium perfringens*
   1. Mode of transmission: foods, especially cooked meat and poultry that have been inadequately cooled
   2. Reservoir: soil and animal feces
   3. Incubation period: average 8-12 hours
   4. Symptoms: abdominal pain, diarrhea

4. Order: Actinomycetales
   a. *Mycobacterium tuberculosis* (Tuberculosis)
      1. Mode of transmission: contact with patients with open lesions or ingestion of unpasteurized milk from infected cows.
      2. Reservoir: man, cattle
      3. Incubation period: 4-6 weeks to show lesions
      4. Symptoms: chronic disease; primary skin lesions heal, but occasionally lead to pulmonary tuberculosis; characterized by arrest and remission, cough, fever, fatigue and weight loss

5. Order: Spirochaetales
   a. *Leptospira* (Leptospirosis)
      1. Mode of transmission: contact with water contaminated by urine of infected animals
      2. Reservoir: domestic and wild animals
      3. Incubation period: averages 10 days
      4. Symptoms: fever, chills, headaches, conjunctivitis, muscular pain
   b. *Borrelia recurrentis* (Relapsing Fever)
      1. Mode of transmission: crushing an infective tick or louse, *Pediculus humanus*, into bite-wound or skin abrasion
      2. Reservoir: louse-borne: man, tick-borne; wild rodents
      3. Incubation period; usually 8 days
      4. Symptoms: short fever periods alternating with non-fever periods with several relapses; rashes
      5. Unclassified: Legionaires bacteria
   c) Pathogenic fungi
      1. Coccidiomycosis
      2. Histopiasmosis
      3. Candidiasis
      4. Blastomycosis
      5. Tinea
   d) Rickettsia
1. *Rickettsia rickettsii* (Rocky Mountain Spotted Fever)
   a. Mode of transmission: bite of infected tick, *Dermacentor* & *Amblyomma* species
   b. Reservoir: rodents, dogs, ticks, rabbits
   c. Incubation period: 3-10 days
   d. Symptoms: sudden onset of fever lasting about 2 weeks; rash develops on upper and spreads
   e. Other; not confined to Rocky Mountains
2. *Coxiella burneti* (Q fever)
   a. Mode of transmission: direct airborne and raw milk
   b. Reservoir: ticks, wild animals
   c. Incubation period: 2-3 weeks
   d. Symptoms: sudden onset with chills, headache, weakness, sweating; pneumonitis with mild cough and chest pain
3. Typhus fever
   a. *Rickettsia tsutsugamushi* (scrub typhus)
      1. Mode of transmission: bite of infected larval mites
      2. Reservoir: mites and wild rodents
      3. Incubation period: usually 10-12 days
      4. Symptoms: onset of fever, headache, trunk lesions, pneumonitis
   b. *Rickettsia prowazeki* (Endemic fleaborne typhus fever or Murine typhus) variation typhi
      1. Mode of transmission: infected fleas *Xenopsylla cheopis* defecates bite wound
      2. Reservoir: rats
      3. Incubation period: 6-14 days
      4. Symptoms: sudden onset of fever, chills, headache
   c. *Rickettsia prowazeki* var. *prowazeki* (Epidemic louse-borne typhus fever)
      1. Mode of transmission: body lice, *Pediculus humanus* defecate in bite wound
      2. Reservoir: man
      3. Incubation period: usually 12 days
      4. Symptoms: sudden onset of fever, chills, headache; more serious than above

e) Algae
1. *Gonyaulax catenella* (Paralytic shellfish poisoning, red tide)
   a. Mode of transmission: shellfish, especially musseis and clams concentrate the toxin
   b. Reservoir: oceans
   c. Incubation period: less than one hour
   d. Symptoms: numbness around lips, incoherent speech, respiratory paralysis (neurotoxin)

f) Protozoan
1. *Entameba histolytica* (Amebic dysentery, amebiasis)
   a. Mode of transmission: water, raw vegetables, flies and soiled hands
   b. Reservoir: man
   c. Incubation period: usually 3-4 weeks
   d. Symptoms: mild abdominal discomfort, diarrhea alternating with constipation or chronic or acute diarrhea with mucus and blood; may spread to other organs
2. *Giardia lamblia* (Giardiasis)
   a. Mode of transmission: water, especially mountain streams and lakes
   b. Reservoir: beaver, deer, elk, man
   c. Incubation period:
   d. Symptoms: chronic diarrhea, attacks duodenum and gall bladder
3. *Plasmodium vivax, Plasmodium falciparum* and others (Malaria)
   a. Mode of transmission: bite of infective *Anopholes* mosquito
   b. Reservoir: man
   c. Incubation period: 12-14 days
   d. Symptoms: chills, fever, headache, nausea, profuse sweating; cyclic attacks, may become chronic
4. Leishmaniasis
5. Trypanosomiasis
6. Toxoplasmosis

g) Metazoan Parasites
1. Trematodes
   a. *Schistosoma* (Schistosomiasis)* (blood fluke)
      1. Mode of transmission: enter skin from water contaminated with urine
      2. Reservoir: man; freshwater snails are part of life cycle
2. Cestodes
   a. *Taenia* (Beef and pork tapeworm)
      1. Mode of transmission: ingestion raw or inadequately cooked meat or by fecal oral route
      2. Reservoir: man

Nematodes
a. *Necator* and *Ancylostoma* (Hookworms)
   1. Mode of transmission: eggs in feces develop in soil then penetrate the skin, usually the bare foot
   2. Reservoir: man
b. *Enterobius* (Pinworm)
   1. Mode of transmission: feces to oral route
   2. Reservoir: man
c. *Ascaris* (Roundworm)
   1. Mode of transmission: feces to soil to oral route
   2. Reservoir: man
d. *Trichinella* (Trichinosis)
   1. Mode of transmission: ingestion of inadequately cooked meat containing viable trichinae
   2. Reservoir: swine and many wild animals
e. *Onchocera volvulus** (Onchocerciasis)
   1. Mode of transmission: bite of infected blackflies
   2. Reservoir: man

4. Filaria
   a. *Wuchereria** (Filariasis)
      1. Mode of transmission: bite of mosquito harboring organisms
      2. Reservoir: man

h) Poisonous plants and animals

i) Allergens
   1. Pollen (ex. ragweed)
   2. fungi (ex. spores)
   3. Insects (ex. bee stings)
   4. House dust (ex. animal hair)
   5. Foods (ex. eggs)
   6. Chemical sensitizers (ex. isocyanates)

* Not found in the United States

(b) Chemical factors

1) Inorganic chemicals

a) Metals

1. Alkali metals
   a. Lithium
      1. Where found: removed trace gases from vacuum tubes, desulfurizer, catalyst, hardeners
      2. Health effects: skin and respiratory irritants
   b. Sodium
      1. Where found: In vapor lights, tetraethyl lead alloys
      2. Health effects: hydroxides are caustic, nitrates are preservatives, explosives & fireworks, peroxides are irritants & corrosives
   c. Potassium
      1. Where found: In vapor lights, tetraethyl lead alloys
      2. Health effects: hydroxides are caustic, nitrates are preservatives, explosives
2. Alkali earth metals
   a. Beryllium
      1. Where found: fume or dust phosphor lites, non-spark alloy
      2. Health effects: pneumonitis, cyanosis, chronic breathing, cardiac failure
   b. Magnesium
      1. Where found: silicates, light metals alloys
      2. Health effects: leucocytes, fume fever
   c. Strontium
      1. Where found: flares, luminous paint
      2. Health effects: fires, boneseeker
   d. Barium
      1. Where found: oil and gas drilling
      2. Health effects: baritosis pneumonitis
3. Transitional metals
   a. Iron salts
      1. Where found: mining & welding
      2. Toxicology: "siderosis," pneumonia and emphysema, fume fever, respiratory irritant
   b. Chromic acid
      1. Where found: nichrome heating elements, plating
      2. Toxicology: VII bronchogenic, perforated nasal septum, chrome-plating
   c. Manganese
      1. Where found: welding
      2. Toxicology: spastic and psychological symptoms, pneumonitis
   d. Cobalt
      1. Where found: tungsten carbide industry

e. Nickel
1. Where found: money values, plating
2. Toxicology: nickel carbonyl: carcinogen; dermatitis

f. Copper
1. Where found: electricity, plumbing alloys
2. Toxicology: fume fever, eye and nasal irritation

g. Tin
1. Where found: plating, soldering
2. Toxicology: pneumonitis "stanosis"

h. Organotins
1. Where found: PVC stablizers, biocides
2. Toxicology: liver, kidney, pulmonary, central nervous system

i. Zinc
1. Where found: galvanizing, alloys, white paint
2. Toxicology: fume fever

4. Heavy metals

a. Lead
1. Where found: scrap metals, ship-breaking, batteries, paint
2. Toxicology: anemia, paralysis, respiratory failure, brain damage, wrist drop, psychological symptoms

b. Mercury
1. Where found: electric apparatus, biocides, mining production, (Cl_2+NaOH)
2. Toxicology: gastrointestinal impairment, inflammed mouth and gums, central nervous system tremors, psychological symptoms

c. Cadmium
1. Where found: plating, alloys
2. Toxicology: kidney and testes necrosis, poisoning - vomiting, diarrhea, cramps, fumes, pneumonitis, emphysema

d. Chromium
1. Where found: plating, production of chromate, Cr pigments
2. Toxicology: bronchogenic, skin ulcer, nasal septum

e. Arsenic
1. Where found: medicine, glass manufacturing, biocides
2. Toxicology: carcinogen, dermatitis, gastrointestinal, possible teratogen, respiratory impairment

b) Other Inorganic

1. Nitrates
a. Where found: fertilizer, sewage
b. Toxicology: met-Hg,possible cancer

2. Asbestors - hydrated Mg & Si
a. Where found: insulation, mining, shipbuilding
b. Toxicology: asbestosis, cancer of lung and mesothelioma, emphysema

3. Fibrous glass
a. Where found: insulation (thermal and acoustical), reinforcers; plastic, rubber, paper
b. Toxicology: possible carcinogen, lung function, irritant

4. Selenium
a. Where found: by-product in metal refining, insecticides, rubber and glass industry, coal emissions, tobacco
b. Toxicology: *acute*: eye and respiratory irritant, headache, convulsions, throat edema
chronic: mental depression, weakness, gastrointestinal, disorders, excessive perspiration, nervousness, garlic-like oder and taste, kidney and liver impairment

71

2) Organic Chemicals
   a) Straight chain hydrocarbons
      1. Aliphatics
         a. Where found: fuels, solvents, degreasers
         b. Health effects: simple asphixiant, narcotic irritant
      2. Halogenated aliphatics
         a. Where found: same as analogs, but non-flammatory
      3. Alkenes
         a. Where found: products of cracking, synthetic chemistry, polymerization
         b. Health effects: simple asphixiant - anesthetic
      4. Alcohols
         a. Where found: methanol, solvents, glycols
         b. Toxicology: skin and mucous irritant; CNS depressant; kidney and liver toxin
   b) Alicyclic hydrocarbons
      1. Mixed hydrocarbons
         a. Where found: fuels, gasoline
         b. Health effects: benzene (carcinogen) narcotic, pneumonitis
      2. Aromatics
         a. Where found: coking, solvents, chemical synthesis
         b. Toxicology: respiratory and skin irritation, central nervous system depression, benzene carcinogen
      3. Halogenated aromatics
         a. Where found: pesticides and solvents, transformers (PCBs)
         b. Toxicology Hepatoxic, skin, eye irritant
      4. NO_2-NH_3 Aromatics (Aniline dyes)
         a. Where found: dyes, explosives, hepatoxic
         b. Toxicology: sensitizers, bladder carcinogen
      5. Phenolics
         a. Where found: explosives, plastics, fertilizer
         b. Toxicolocy: strong irritation, cyanotic, kidney and liver
      6. Isocyanates - toluene diisocyanate
         a. Where found: polyurethane plastics, foams rubbers
         b. Toxicology: irritant, respiratory irritant sensitizer, lung function
      7. Organophosphates
         a. Where found: malathion, parathion, fenthion, diazinon
         b. Toxicology: interfers with acetylcholinesterase enzyme; symptoms: abdominal pain, headache, blurred vision, tremors, dizziness, weakness, contracted pupils

(c) Physical factors
   1) Mechanical
      a) Motor vehicle accidents
         1. leading cause of accidental deaths
      b) Residence-related accidents
         1. Accidental falls is second leading cause of accidental deaths
         2. Accidental drowning is fourth leading cause of accidental deaths
         3. Other important types are: open flames, hot surfaces and liquids, medicines, sharp edges, electricity and lawn mowers
      c) Work-related
         1. Accidents caused by fire and explosion of combustible material is the third leading cause of accidental deaths
         2. Other important types in addition to those listed in 1.b.3 above are: chemical burns, exposure to toxic gases and unsafe operation of machinery
      d) Disasters
         1. Natural disasters cannot be prevented, but proper land use planning can mitigate their damage. Examples are: earthquake, avalanche, rockslides, mudslides, flooding, wildfire, etc.

2) Noise
   a) Measurement of sound
      1. Loudness
         a. dB = 20 log (P/Po) where dB is decibels, P = the given sound pressure and Po is the sound pressure of minimum audible sound. Logarithims permit the use of manageable numbers
         b. Doubling of sound pressure results in an increase of 3 dB
      2. Ratings of common noise sources:

dB	Rating
0	Threshold of hearing
30	very quiet (library)
60	Intrusive (conversation)
90	Very annoying (power lawnmower) hearing damage at 8 hours
120	Maximum vocal effort (jet aircraft flyover)

      3. Frequency is also measured since the human ear does not hear all frequencies
      4. Noise from point source decreases with distance according to the inverse square law so that a doubling of distance results in a reduction of about 6 dB
   b) Effects of noise
      1. Physiological effects
         a. Loss of hearing: instantaneous with rupture of ear drum or chronic with continuous exposure to noise levels of 90 dB
         b. Headache, fatigue and general body stress, sleep deprivation
      2. Speech interference
      3. Psychological
         a. Invasion of privacy may trigger anger, tension, fear and anxiety
   c) Sources
      1. Vehicles
      2. Workplace - machinery
      3. Residence - stereos, aircraft, vehicles, machinery
3) Electromagnetic energy
   a) Knowledge of the electromagnetic spectrum, particularly how the various energy forms interrelate
   b) Ionizing radiation
      1. Types
         a. Alpha radiation
            1. Characteristics: low penetration (will not penetrate the skin); more significant as an internal emitter
         b. Beta radiation
            1. Characteristics: penetrate more than alpha; have internal and external emitter significance
         c. X-rays
            1. Characteristics: highly penetrating, important external hazards
      2. Sources
         a. Radiation from the earth: coal contains radioactive material that is released when burned
         b. Solar radiation: production of radioactive agents by cosmic radiation in the atmosphere
         c. Cosmic radiation
         d. Man-made radiation
            1. Production of nuclear fuel
            2. Use of nuclear fuel
            3. Use of radioisotopes in industry, medicine and research
            4. Testing of nuclear weapons

3. Heath effects
   a. Of selected radionuclides:
      1. Strontium 90 & 89 irradiate the skeleton
      2. Cesium 137 irradiates soft tissues
      3. Carbon 14 produces whole body radiation
      4. Iodine 131 irradiates the thyroid gland
   b. Clinical effects
      1. Acute:
         a. Radiation poisoning: loss of hair, skin ulcers, damage to blood-forming organs. Doses of 350-400 rem may be lethal to man
      2. Chronic
         a. Early signs: changes in texture and pigmentation of skin
         b. Cancer
            1. Leukemia demonstrated in early radiologists and victims of atomic bombings
            2. Skin cancer (early radiologists)
            3. Thyroid cancer (children receiving neck X-rays)
            4. Lung cancer - occupationally exposed workers in metal and uranium mining
            5. Bone cancer - radium dial painters
         c. Cataracts (atomic bombing victims)
         d. Shortened life span (bombing victims, radiologists and animals
         e. Teratogenicity (genetic injury)

c) Non-ionizing radiation
   1. Types
      a. Ultra-violet radiation
         1. Sources: disinfectant properties, fluorescent lights, direct sunlight, electric welding arcs, photo engraving
         2. Health effects:
            a. Eye: inflammation of cornea
            b. Skinburn
      b. Visible energy
         1. Sources: sunlight, artificial light
         2. Health effects:
            a. Inadequate lighting causes eye fatigue, headache
            b. Sunburn
      c. Infrared radiation
         1. Sources: paint drying, dehydrating textiles, paper and other materials
         2. Health effects:
            a. Eye: injury and production of cataracts
            b. Skinburn
      d. Microwaves and radio waves
         1. Sources: television, FM and radar transmitters, medical diathermy, microwave ovens
         2. Health effects: heating of tissues. Lower frequencies penetrated deeper into tissues, especially at exposures of less than 3000 MH^2. Also possible cataract and gonadal damage may result
      e. Lasers
         1. Description: high intensity light radiation of a single wave length
         2. Health effects: primarily eye hazard

4) Climate factors
   a) Temperature
      1. Heat
         a. Health effects: sunstroke, heat exhaustions, lowered production
      2. Cold and windchill
         a. Health effects: lowered production, frostbite, hypothermia
   b) Pressure
      1. Health effects: hypoxia (altitude sickness) decompression and compression (bends)
   c) Humidity
      1. Health effects: high humidity contributes to heat stress

5) Particulates
a) Types
1. Dust: solid airborne particles 0.1-25 in size
a. Sources: atmospheric, industrial, mining
b. Health effects: pneumoconioses
2. Smoke: carbon particles less than 0.1
a. Source: combustion
b. Health effects: bronchitis, emphysema, lung cancer
3. Fume: solid particles generated by condensation from the gaseous state
a. Source: metals such as Zn, Fe
b. Health effects: fume fever, respiratory impairment
4. Aerosols: liquid droplets suspended in air over long times
5. Mists: Suspended droplets that fall out quickly

6) Dangerous gases
a) Toxic and corrosive gases
1. Criteria air pollutants
a. Carbon monoxide
1. Source: incomplete combusion of fuel, especially from motor vehicles
2. Health effects: CO has a greater affinity to hemoglobin
a. Acute: headache, dizziness, fatigue, psychomotor impairment, death
b. Chronic: damage to the heart; may induce atherosclerosis
b. Sulfur Oxides
1. Source: combustion of fossil fuels
2. Health effects: as synergen with particulates, SO_2 has been associated with greater mortality and respiratory irritant, causing pulmonary edema
c. Nitrogen oxides
1. Source: naturally occurring and from combustion of fossil fuels
2. Health effects:
a. Acute: respiratory irritant and can cause pulmonary edema and death
d. Oxidants
1. Source: produced in the atmosphere by complex reactions with other pollutants especially oxides of nitrogen
2. Health effects:
a. Acute pulmonary edema, decreased lung function
b. Chronic: pulmonary diseases such as emphysema and bronchitis have been produced in laboratory animals. May produce premature aging of alveolar wall
2. Other toxic and corrosive gases include chlorine, ammonia and hydrogen sulfide
b) Explosive and combustible gases include: acetylene, butane, formaldehyde methane, picric acid.

(d) Knowledge of the interrelatedness of multiple environmental factors in disease causation
1) Synergistic effects: two or more chemicals produce an effect different than either chemical produces alone
a) Additive effects: two chemicals produce an effect approximately twice that effect of either chemical alone
Example: Cigarette smoking and air pollution effects may be additive
b) Multiplicative effects: two or more chemicals produce an effect several times greater than that produced by either chemical alone.
Example: the risk of death from lung cancer by an asbestos worker who smokes is 8 times greater than the smoker not exposed to asbestos and 92 times that of the non-smoking person who does not work with asbestos
2) Accelerator effects: one chemical enables or enhances the toxic effect of another chemical.
Example: soot, an otherwise harmless substance becomes a powerful carcinogen because of its tendency to absorb carcinogenic agents and convey them into the tracheobronchial tree

b. Knowledge of environmental factors and epidemiology
(1) Knowledge of the modes of transmission
(a) Direct transmission
1) Direct contact with an infected person
2) Droplet: exposure to and inhalation of respiratory aerosols containing infectious agents

Demonstrates appreciation of economic, social and ecological relationships in Public Health (A)

Skill in the using epidemiology to analyze acute disease
Skill in using epidemiology and vital statistics to help identify: causative agent and mode of transmission in acute disease
Skill in establishing or improving disease reporting system

(b) Indirect transmission

1) Animate objects (vectors): An animal vector inoculates the host with the infectious agents

2) Inanimate objects:

a) Vehicles: food, water, milk or other biological products through which an infectious agent is transmitted to the host

1. Potentially hazardous foods

b) Airborne: Particles harboring infection agents that are suspended in the air

c) Fomites: contaminated objects harboring infectious agents

(2) Knowledge of the toxicologic mode of action

(a) Dose-response

1) LD_{50} = that concentration exposure at which 50% of the population experiences death

2) TLV: threshold limit value is that concentration to which workers may be exposed all day without adverse effect

3) TWA – time-weighted averages allow excursions above the TLV provided they are compensated by equivalent excursions below the limit during the workday

(b) Toxicity exposure is a function of time as well as dose

1) Toxicity ratings: substances are rated by their LD 50 from extremely toxic to relatively harmless

(3) Knowledge of the portals of entry and exit and of the body's defenses

(a) Respiratory

1) Nasal passages: warming, humidifying and clearing of large particles

2) Windpipe and bronchi: cilia carry mucous with contaminates up to esophagus

77

Skill in utilizing appropriate epidemiologic methods
  Skill in calculating attack rates/morbidity rates
  Skill in constructing an epidemic curve to determine average time of onset
    Skill in applying incubation periods to assist in agent identification
Skill in interpreting all the data to identify the agent and mode of transmission (cross-reference III)
  Skill in applying symptomologies to assist in agent identification
  Skill in applying food histories to assist in agent identification

3) Bronchial tubes: constrict on irritation and produce cough or sneeze which is another clearance mechanism
4) Alveoli: particles smaller than 0.5u are likely to reach the alveoli
a) Capillary action flow of alveolar fluid to brochioles
b) Phagocytosis of particles or organisms

(b) Gastrointestinal
1) Saliva - mildly bactericidal
2) Stomach - low pH destroys most organisms
3) Intestine: mucous movement collects material which is removed in the feces
4) Normal flora: represent competition for invading pathogens
5) Toxic substances may be excreted in sweat or feces

(c) Genitourinary
1) Genitourinary secretions are bactericidal; these organs are remarkably free from bacteria; kidney detoxifies and excretes toxic substances

(d) Open lesions
1) Inflammatory reaction occurs stimulating:
a) Celular response: leuc ocytes
2) Immunity: resistance associated with possession of antibodies having specific action on an infectious organism
a) Passive immunity - received from others
1. Naturally - maternal transfer
2. Acquired - inoculation of antibodies or immune serum
b) Active immunity - formed by body
1. Natural - from infection
2. Acquired - inoculation of killed agent or its products

(e) Percutaneous
1) Skin is barrier to bacteria
2) Trauma defenses
a) Sensory signals - heat, cold, pain
b) Resilient collagen tissue
c) Self-repairing properties
3) Personal hygiene maintains clean skin
4) Some toxic materials especially those lipid soluble
Substances easily penetrate the skin; some toxic substances are excreted in sweat

(f) Conjunctiva

(4) Knowledge of the social environment
(a) Social factors important in disease causation
1) Religion
2) Customs
3) Socio-economic status
4) Social mobility
5) Occupation
6) Marital status
7) Education
8) Geographic mobility
9) Place of residence
10) Housing

(5) Knowledge of the physical environment
(a) Geographical factors influencing the occurrence of disease
1) Climate
a) Temperature, solar radiation
b) Precipitation, humidity
2) Physiography
a) Soil and geology
b) Water supplies
c) Altitude
d) Trace elements
e) Population distribution
(6) Knowledge of host factors
(1) Intrinsic factors
a) Age
b) Sex
c) Race
d) Genetic factors
1) Genetic diseases
2) Teratogens
3) Allergy and sensitivity
4) Physical and mental handicaps
(e) Immunologic state of individual
(2) Extrinsic factors:
(a) "Herd" immunity
(b) Personal habits - alcohol, tobacco, diet
(c) Nutritional state
(d) Psychological stress

2. Knowledge of chronic disease causation
a. Knowledge of agent factors*
(1) Biological
(2) Chemical
(3) Physical
(4) Multiple
b. Knowledge of environmental factors* and epidemiology
(1) Biological environment
(2) Physical environment
(3) Social environment
c. Knowledge of host factors*
(1) Intrinsic: age, sex, race
(2) Extrinsic: diet, stress, personal habits
d. Knowledge of characteristics of chronic disease
(1) Degenerative nature
(2) Long latency periods
(3) Primarily inpacts the aged
(4) Frequently incurable

Skill in using epidemiology to analyze chronic disease
- Skill in using epidemiology and vital statistics in the indentification of the causative agent and mode of transmission in chronic disease
  - Skill in collecting morbidity and mortality data
  - Skill in collecting census data
  - Skill in calculating rates and ratios,
    - Crude death rates
    - Standard mortality ratios
    - Case fatality rate
    - Morbidity rates
      - Incidence rates
      - Prevalence rates
  - Skill in adjusting rates for age, sex and other factors
  - Skill in calculating relative risk
  - Skill in controlling for geographical and social mobility
  - Skill in assessing community health status
- Skill in designing and conducting community studies
  - Skill in random sampling

3. Knowledge of injury causation
   a. Knowledge of agent factors*
      (1) Physical
      (2) Chemical
      (3) Multiple
   b. Knowledge of environmental factors* and epidemiology
      (1) Biological environment
      (2) Physical environment
      (3) Social environment
   c. Knowledge of host factors*
      (1) Intrinsic: host error, age, sex skillfulness
      (2) Extrinsic: machine and system design (ergonomics)
   d. Knowledge of important causes of accidental injury and death
      (1) Ranked accident mortality
         (a) Motor vehicle accidents
         (b) Accidental falls
         (c) Fire and explosion
         (d) Accidental drowning

*For more detail, see identical headings under I. A

B. Knowledge of Control and Prevention in Disease, Injury and Environmental Damage
   1. Control and disease prevention measures crossing program areas
      a. Isolation
         (1) Embargo
         (2) Quarantine
         (3) Containerization - toxic chemical production
         (4) Environmental barriers: examples
            (a) Harzardous and radioactive waste disposal
            (b) Sanitary landfill practices
            (c) vault privy
            (d) Protection of water supply by location
      b. Shielding
         (1) Shielding of machinery
         (2) Personal protective devices; examples: respirators, goggles and leaded x-ray sheilding
         (3) Environmental barriers; examples:
            (a) Sneezeguards
            (b) noise barriers
            (c) source protection of water supplies by design
            (d) cross connection control

Skill in interpreting confounding cultural and socio-economic factors in community studies of chronic disease
- Inter-regional comparisons
- Temporal comparisons
- Cultural and socio-economic comparisons

Skill in using epidemiology to identify proper control techniques to minimize preventable chronic disease
Skill in working with physicians, nurses, epidemiologists, laboratory personnel (cross-reference V)

Skill in using the epidemiology in the analysis of injury causation
- Skill in using epidemiology and vital statistics in the identification of the causative factor and mode of occurrence
  - Skill in the collecting morbidity and mortality data
  - Skill in collection of census data
  - Skill in calculating rates and ratios
    - Crude death rates
    - Standard mortality ratios
    - Case fatality rate
    - Morbidity rates
      - Incidence rates
      - Prevalence rates
  - Skill in adjusting rates for age, sex and other factors
  - Skill in calculating relative risk
  - Skill in controlling for geographical and social mobility
- Skill in assessing community injury status
  - Skill in designing and conducting community studies
    - Skill in random sampling
  - Skill in interpreting confounding cultural and socio-economic factors: in community
    - Inter-regional comparison
    - Temporal comparisons
    - Cultural and socio-economic
  - Skill in using epidemiology to identify proper control techniques to prevent injuries
  - Skill in working with physicians, nurses, epidemiologists, laboratory personnel (cross-reference VI)

Skill in selecting the proper control technique
- Skill in applying epidemiological data to the need for control measures
- Skill in observing hazards
- Skill in assessing degree of hazard
- Skill in balancing alternatives (problem solving)
- Skill in working with health educators, engineers, teachers, architects and planners (cross-reference VI)

Expresses a willingness to work extra time in problem solving (A)

Uses innovative thinking to solve problems (A)

Endeavors to prevent problems rather than abate them (A)

c. Substitution
   (1) Substitution of a substance or process for a toxic substance or process
   (2) Substitute a biodegradable chemical for a non-biodegradable one
d. Treatment
   (1) Physical treatment processes
      (a) Air
         1) Ventilation
         2) Precipitation; example: electrostatic precipitators
         3) Absorption, example: scrubbers
         4) Absorption: impingers
         5) Centrifugal; example: cyclones
         6) Catalytic combustion
         7) Diffusion; example: scrubbers
      (b) Water
         1) Sedimentation
         2) Filtration
         3) Adsorption
         4) Comminution
      (c) Thermal
         1) Disinfection
         2) Drying
         3) Evaporation
         4) Incineration
         5) Pasteurization
         6) Sanitization
         7) Refrigeration and freezing

   (2) Chemical treatment processes
      a) Land
         1) Pesticides application
      b) Water
         1) Disinfection
         2) Sanitization
         3) Flocculation
         4) Coagulation
         5) Neutralization; example: corrosion control
         6) Ion exchange; example: water softening
         7) Fluoridation
         8) Emulsification; example: soaps and detergents

   (3) Biological treatment processes
      a) Aerobic
         1) Aeration; example: activated sludge, trickling filter, oxidation ponds, composting, subsurface disposal field
      b) Anerobic
         1) Digestion; example: sludge digestion, methane production, septic tank treatment
         2) Composting
      (c) Plant transpiration; example: evapotranspiration bed
      (d) Animal ingestion; example: *Gambusia*, aquaculture

Maintains personal hygiene appropriate to the job (A)

Projects a positive attitude toward health, safety and well-being (A)

Skill in applying pesticides

e. Resource recovery
(1) Compaction; example: size reduction
(2) Separation
(3) Recovery processes; example:
(a) Composting
(b) Incineration; steam generation
(c) Chemical conversion
1) Pyrolysis
(d) Substance reuse; example: aluminum

f. Planning
(1) Knowledge of the planning process
(a) Problem definition
(b) Goals and objectives
(c) Study and analysis
(d) Alternatives
(e) Implementation
(f) Evaluation and continuing planning
(2) Knowledge of environmental assessment
(a) Types
1) (Federal, state, local) environmental impact statements
2) A - 95 reviews
3) Health system agency reviews
(b) Environmental assessment procedures
1) Description of present environment
2) Description of the proposed action
3) Environmental impact of the proposed action
a) Primary impacts
b) Secondary impacts
4) Alternatives to the proposed action
5) Probable adverse environmental impacts
6) Relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity
7) Irreversible or irretrievable commitments of resources

II. KNOWLEDGE OF ADMINISTRATIVE LAW AND PROCESS

A. Knowledge of Lawful Authority and Its Delegation
1. Knowledge of source and nature of environmental health authority
a. Knowledge of U. S. Constitution
(1) Knowledge of federal powers
(a) Regulate commerce
(b) Levy Taxes and spend money for General Welfare
(2) Knowledge of limitations on federal power
(a) Bill of Rights
(b) Equal Protection
(c) States Rights
(d) Due Process
b. Knowledge of state authority
(1) Knowledge of state powers
(a) Police power
(b) Taxation

Skill in using the planning process

Appreciation of planning as a means of preventing environmental hazards (A)

(2) Knowledge of state power limitations
(a) U. S. Constitution including Supremacy clause
(b) State Constitution

c. Knowledge of local government authority
(1) Knowledge of jurisdiction and authority granted by state
(2) Knowledge of home rule power

2. Knowledge of delegation of authority to agencies
a. Knowledge of extent of delegation and jurisdiction
(1) Knowledge of express authority
(2) Knowledge of implied authority
(3) Knowledge of method to interpret legislation
(4) Knowledge of standards controlling use of authority
(5) Knowledge of consequences of exceeding authority

b. Knowledge of delegation process
(1) Knowledge of legislative structure
(a) U. S. Congress
1. House and Senate
2. Committees and subcommittees
3. Commissions
(b) State Legislatures
1. Upper and Lower House
2. Unicameral
3. Committees and subcommittees
4. Commissions
(c) Legislative districts
(d) Local governments legislative bodies

(2) Knowledge of legislative process
(a) Introduction of bills
(b) Committee hearings

c. Knowledge of authority, jurisdiction and structure of environmental health agencies
(1) Knowledge of federal agencies
(a) Environmental Protection Agency
(b) Department of Health, Education, and Welfare
(c) Department of Agriculture
(d) Department of Housing and Urban Development
(e) Department of Labor including the Occupational Safety and Health Administration
(f) Department of Interior
(g) Other agencies
(2) Knowledge of state agencies
(a) Department of Public Health
(b) Other agencies
(3) Knowledge of Regional agencies
(a) Health Systems Agency
(b) Other environmental protection, planning and management agencies
(4) Knowledge of local agencies
(a) County and city health departments
(b) Voluntary and private agencies
(c) Other agencies

Skill in providing information and education to legislators
Skill in drafting and reviewing bills
Skill in enlisting public interest, participation and support for new legislation

B. Knowledge of agency acquisition and retention of information
  1. Knowledge of law on inspections
    a. Knowledge of express requirements in code
    b. Knowledge of methods of lawful inspections
      (1) Knowledge of consent inspections
        (a) When consent is required
        (b) Authority for consent
      (2) Knowledge of warrant method
        (a) When warrant is needed
      (3) Knowledge of emergency inspections
      (4) Knowledge of "plain view" inspection
        (a) Public places
        (b) Plain view
      (5) Knowledge of "open fields" method
      (6) Knowledge of effect of licensing
        (a) Cannot compel waiver of constitutional right
        (b) Revoke, suspend, or deny license
    c. Knowledge of consequences of unlawful inspection
      (1) Knowledge of exclusionary rule
      (2) Knowledge of tort liability
  2. Knowledge of legal methods to obtain information from regulated activities
    a. Knowledge of reporting and record keeping requirements
      (1) Knowledge of self-inspection reports
      (2) Knowledge of accident and injury reports
      (3) Knowledge of repair and maintenance reports
      (4) Knowledge on sanctions for non-reporting and falsification of records
    b. Knowledge of subpoena
      (1) Knowledge of availability
    c. Knowledge of confidential and privileged information
  3. Knowledge of management, retention, and disclosure of information
    a. Knowledge of control records
      (1) Knowledge of records required
      (2) Knowledge of required retention period
      (3) Knowledge of employee access and control of records
    b. Knowledge of lawful disclosure of records
      (1) Knowledge of Freedom of Information Act
      (2) Knowledge of Privacy Act
      (3) Knowledge of need to protect trade secrets and other private information
C. Knowledge of lawfulness of agency administrative actions
  1. Knowledge of informal administrative actions
    a. Knowledge of required factual basis to make decisions
    b. Knowledge of need for record on action
    c. Knowledge of amount of agency discretion available
    d. Knowledge of subject matter within scope of informal powers
    e. Knowledge of requirements in Administrative Procedures Act
  2. Knowledge of permits, licenses, and registration
    a. Knowledge of legal difference between permit, licenses and registration
    b. Knowledge of requirements for application, issuance, suspension, and revocation of each
    c. Knowledge of authority to use technique and effect on competitors
  3. Knowledge of embargo, seizure, condemnation, and abatement of nuisances
    a. Knowledge of differences between and effectiveness of each
    b. Knowledge of legal requirements for and consequences of each section
  4. Knowledge of rules and regulations
    a. Knowledge of importance of agency regulations
    b. Knowledge of rule making
      (1) Knowledge of formal statutory requirements
      (2) Knowledge of notice and publication of rules

Skill in obtaining warrant
Skill in using warrant

Skill in acquiring a subpoena
Skill in using documents obtained

Interpreting and applying regulations
Specifying agency procedures

Skill in drafting and reviewing regulations

91

D. Knowledge of enforcing environmental health laws
  1. Knowledge of enforcement alternatives
    a. Knowledge of criminal actions
      (1) Knowledge of penalties - felony, misdemeanor
      (2) Knowledge of initiation of criminal actions
      (3) Knowledge of trial process
      (4) Knowledge of defendant's rights
      (5) Knowledge of advantages and disadvantages of criminal actions
    b. Knowledge of civil actions
      (1) Knowledge of civil penalties
      (2) Knowledge of injunctions
        (a) Obtaining injunction
        (b) Duration and effect of injunction
      (3) Knowledge of advantages and disadvantages
    c. Knowledge of administrative actions
      (1) Knowledge of violation orders, orders to abate, and orders to cease and desist
        (a) Procedure
        (b) Scope of remedy
        (c) Sanctions for non-compliance
      (2) Knowledge of administrative hearings
        (a) Types of hearings (formal/informal)
        (b) Notice to parties and due process rights
        (c) Record of hearing and decision
        (d) Exhaustion of administrative remedies doctrine
  2. Knowledge of Rules of Evidence
    a. Knowledge of differences in evidence required and types allowed depending on type of enforcement action
    b. Knowledge of basis for admission
    c. Knowledge of witnesses testimony
      (1) Knowledge of opinion evidence
        (a) Lay witness
        (b) Expert witness
      (2) Knowledge of cross-examination
        (a) Right of cross-examination
        (b) Scope of cross-examination
      (3) Knowledge of hearsay rule and exceptions
E. Knowledge of personal and agency liability
  1. Knowledge of civil liability
    a. Knowledge of tort liability
      (1) Knowledge of negligence liability and duty of due care
      (2) Knowledge of liability in civil rights cases
      (3) Knowledge of defamation, slander, and libel
      (4) Knowledge of malicious prosecution (including harassment)
      (5) Knowledge of intentional torts
        (a) Trespass
        (b) False imprisonment
        (c) Conversion of chattels
      (6) Knowledge of nuisance
F. Knowledge and legal resources
  1. Knowledge of need for, and location of legal staff
    a. Knowledge of legal problems and need for assistance
    b. Knowledge of source and location of legal assistance
  2. Knowledge of legal materials
    a. Knowledge of federal materials
      (1) Knowledge of federal statutes
        (a) Statutes-at-large

Maintains an objective attitude (A)
Maintains no difference in life style and attitudes (A)

Conduct of hearing

Skill in presenting evidence including: photographs, samples, and test results
Skill in maintaining the chain of custody
Skill in authenticating and documenting:
  Calibrating of equipment
  Methods of analysis
Skill in methods of identifying evidence:
  Marking methods
  Identifying markings
  Using supplementary notes
Skill in report writing
Skill in writing for complete, detailed reports
Skill in the methods of authenticating, identifying and custody of official records
Skill in providing expert witness testimony
Skill in recognizing and avoiding witness impeachment
  Prior inconsistant statement
  Contradiction
  Bias or prejudice
  Character
  Incompetency
Attributes in courtroom protocol:
Acceptable behavior in court (A)
Courtesy and honesty (A)
Answer question asked (A)
Dress (A)
Seating and present (A)
Skill in preparing for trial
Skill in assisting attorney
  Gathering material
  Consulting with attorney
  Citing authority
Skill in communicating with lawyers
  terminology
  procedures

(b) U.S. Code
(c) Congressional committee reports and hearings
(2) Knowledge of federal regulations
(a) Code of Federal Regulations
(b) Federal Register
(3) Knowledge of landmark decisions in federal court cases
(a) U.S. Supreme Court cases
(b) Court of Appeals cases
(c) District Court cases
b. Knowledge of state materials
(1) Knowledge of state statutes
(a) Session acts
(b) State code
(c) Enabling legislation
(2) Knowledge of state regulations
(3) Knowledge of state court cases
(4) Knowledge of local regulations, ordinances

G. General knowledge of major federal environmental health laws
1. Clean Air Act, 1970, and Amendments, 1977
2. Clean Water Act, 1977
3. Resource Conservation and Recovery Act, 1976
4. Occupational Safety and Health Act
5. Toxic Substances Act, 1976
6. National Environmental Policy Act, 1969
7. Safe Drinking Water Act, 1974
8. Food, Drug and Cosmetics Act, 1938
9. Public Health Service Act, 1944
10. Federal Insecticide, Fungicide and Rodenticide Act
11. Fair Packaging and Labeling Act, 1966

III. KNOWLEDGE OF THE UTILIZATION OF RESOURCES IN THE COLLECTION, ARRANGEMENT AND INTERPRETATION OF DATA

A. Knowledge of the Acquisition of Environmental Health Data
1. Published sources
a. Criteria documents
b. Annual reports
c. Technical literature
d. Literature indices
e. Vital statistics
f. Environmental impact statements
2. Unpublished sources
a. Agency or industry reports

3. Knowledge of environmental health sampling and testing
a. Instrumentation, equipment and samples commonly utilized in environmental health
(1) Sample medium
(a) Ambient air
1) Samples collected
a) Carbon monoxide
b) Oxides of Sulfur
c) Oxidants
d) Oxides of nitrogen
e) Hydrocarbons
f) Total suspended particulates
g) Opacity
h) Methane

94

Keeps Abreast of New Developments (A)

Skill in Organizing Environmental Health Knowledge
- Skill in using libraries and technical journals
- Skill in organizing files
- Skill in recording data
- Skill in transfering technology

Skill in Environmental Health Sampling and Testing
- Skill in selecting appropriate tests
- Skill in using field equipment
- Skill in reading instruments
  - Calibration
  - Technique
  - Operation and maintenance
- Skill in collecting samples
- Skill in recording data
- Skill in working with laboratory personnel

Cognizant of Small Details (A)
Profits from Mistakes (A)
Manages Time Effectively (A)

2) Instrument or equipment
   a) Carbon monoxide analyzer
   b) Gases in sampling stations
   c) Hi-vol particulate sampling stations
   d) Ringleman chart
   e) Stack sampling instruments
   f) Traffic counters
   g) Computer and modeling programs
   h) Meterologic instruments
   i) Automobile emissions testing equipment
   j) Methane detector

(b) Hazardous environment air
   1) Samples collected
      a) Anesthetic and sterilants
      b) Toxic, explosive and corrosive gases
      c) Harmful particulates
   2) Instruments or equipment
      a) Air sampling: particulates
         1. Filters
         2. Impactors
         3. Impingers
         4. Electrostatic precipitators
         5. Thermal precipitators
         6. Centrifugal devices
      b) Air sampling: gases
         1. Absorption tubes
         2. Absorption impingers
         3. Indicator tubes
         4. Indicator paper
         5. Explosimeters
         6. Instrument readout

(c) Food
   1) Samples collected or test conducted
      a) Milk samples
         1. Phosphatase
         2. Sediment
         3. Milkfat
         4. Ring test
         5. Bacteria
            a. Total count
            b. Specific organisms
         6. Leucocyte counts
         7. Radiological contaminants
      b) Foodstuff samples
         1. Preservatives
         2. Adulterants
         3. Misbranding
         4. Hamburger fat
         5. Bacteria
            a. Total count
            b. Specific organisms
         6. Radiological contaminants
   2) Instrument or equipment (laboratory excluded)

Performs with Accuracy (A)
Dedicated to Excellence (A)
Completes Work on Time (A)

97

a) Sample containers
b) Maximum registering thermometer
c) Dial thermometer
d) Swab-rinse test kit
e) Sanitizer test kit
f) Holding time test kit
g) Phosphatase test kit
h) Light meter
i) Velometer
j) Ultraviolet light
k) Camera
l) Flashlight

(d) Structures
1) Samples collected (other than water or sewage)
a) Carbon monoxide
b) Surface bacteria
c) Airborne bacteria
d) Lead Paint
2) Instruments or equipment
a) Carbon monoxide analyzer
b) Lead paint detector (x-ray fluoresence)
c) Circuit tester
d) Swab-rinse kit
e) Rhodac plates
f) Air sampler for bacteria
g) Velometers
h) Thermometers
i) Vacuum pressure detector

(e) Land
1) Samples collected
a) Soil samples for:
1. Heavy metals
2. Radiation
3. Pesticides
4. Other toxic materials
2) Instruments or equipment
a) USGS and other maps
b) Aerial photographs
c) Surveying equipment
d) Land use maps

98

(f) Energy
1) Tests conducted
a) Light
b) Sound
c) Electromagnetic
1. Microwave
2. X-ray
3. Ionizing radiation
2) Instruments or equipment
a) Light meter
b) Sound level analyzer
c) Octave level analyzer
d) Electro-magnetic
1. Microwave detector
2. X-ray detector
3. Personal dosimeter
4. Geiger counter
5. Scintillators
6. Leaded shields

(g) Vectors
1) Samples collected
a) Vector and reservoir sampling
1. Mosquitoes
2. Fleas
3. Ticks
4. Rabid mammals
5. Mites
6. Lice
7. Arachnida
8. Flies
9. Roaches
10. Scorpions
11. Certain mammals and birds
2) Instruments or equipment
a) Adulticide applicator
b) Larvacide applicator
c) Pesticides
d) Mosquito light trap
e) Scutter's fly grill
f) Dissection instruments
g) Stereo microscope
h) Rodent traps
i) Bleeding equipment

(h) Water
1) Samples or tests analyzed in the field
a) Chlorine or sanitizer residual
b) pH
c) Hardness
d) Alkalinity
e) Dissolved oxygen
f) Temperature
g) MBAS (detergents)
h) Percolation test
i) Soil profile
j) Slope

Skill in Identifying Vectors

2) Samples collected for laboratory analysis
   a) BOD
   b) COD
   c) Nitrate-nitrogen
   d) Turbidity
   e) Coliform bacteria
   f) Phosphates
   g) Sulfates
   h) Chlorides
   i) Oil and grease
   j) Dissolved solids
   k) Suspended solids
   l) Alkyl benzene sulfonate
   m) Inorganics: As, Ba, Cd, Cr, Pb, Hg, Nos-N, Se, Ag, F
   n) Organics
      1. Chlorinated hydrocarbons
      2. Chlorophenoxys
   o) Coliform bacteria
   p) Radiological contaminants
3) Instruments or equipment (excluding laboratory)
   a) Water test kit
   b) Dissolved oxygen analyzer or test kit
   c) MBAS test kit
   d) Thermometer
   e) Composite sampler
   f) Slopemeter
   g) Tracer dye
   h) Sample bottles
   j) Nessler tubes
   k) Vacuum pressure test kit
   l) Computer and programs

b. Personal protective equipment
   (1) Ear protection
   (2) Eye protection
   (3) Respirators
   (4) Protective clothing
c. Criteria for selection of sampling and testing
   (1) Knowledge of sample network
   (2) Knowledge of sample location
d. Knowledge of sample identification and handling

B. Knowledge of the Utilization of Environmental Health Data
   1. Knowledge of environmental health standards
      a. Meaning of standards and indicators
         (1) Microbial indicators
         (2) Pollutant standards
         (3) Threshold limit values

Skill in identifying Samples and Field Conditions
Skill in interpreting Data
- Skill in applying data to environmental standards and indicators
- Skill in presenting data: charts, graphs, tables
- Skill in use of literature or documentation
- Skill in mathematics: fractions, decimals, ratios, proportions, etc.
- Skill in the use of epidemiology techniques
- Skill in reading blueprints or reviewing plans
- Skill in map interpretation

C. Knowledge of Quantitative Methods
  1. Knowledge of the scientific method
    a. Observation
    b. Hypothesis generating
      (1) Independent variable
      (2) Dependant variable
    c. Hypothesis testing
      (1) Use of controls
      (2) Bias
    d. Application, control and prediction
  2. Knowledge of the use of statistics
    a. Descriptive statistics
      (1) Mean, variance, standard deviation, frequency table, histogram and curve
    b. Inferential statistics
      (1) Random and stratified sampling
      (2) Statistical tests
      (3) Statistical significance
      (4) Validity and reliability

IV. KNOWLEDGE OF ENVIRONMENTAL HEALTH ADMINISTRATION

A. Knowledge of the Organization
  1. Knowledge of Organization Theory
    a. Bureaucratic Model
    b. Political Model
    c. Organizational Development
  2. Knowledge of the goals and objectives of the organization
    a. Mission
      (1) Goals
        (a) Objectives
  3. Knowledge of the organization of the agency, or industry
    a. Organizational chart
    b. Division of responsibility
B. Knowledge of Management Principles
  1. Personnel management and development
    a. Needs assessment
    b. Recruitment and employment
    c. Training and career development
    d. Supervision and evaluation
  2. Fiscal management
    a. Budgeting
      (1) Relation to program evaluation
    b. Accounting
    c. Purchasing
  3. Office management
    a. Data processing
      (1) Vital statistics
      (2) Reports
      (3) Legal documentation
      (4) Permits and Licenses
    b. Conducting meetings
      (1) Staff meetings
      (2) Hearings
      (3) Citizen advisory meeting
    c. Office communications
      (1) Policies memoranda
      (2) Carbon copy referencing

Skill in using arithmetic statistics

Skill in organizing

Works Well as a Team Member (A)
Conforms to Departmental Policy (A)
Uses Initiative to Motivate Oneself (A)
Skill in managing personnel
  Skill in assessing manpower needs
  Skill in recruiting and training employees
  Skill in stimulating motivation and incentive to employees
  Skill in directing office procedures
  Skill in supervising employees
  Skill in evaluating job performance
    Skill in establishing realistic performance
Accepts constructive criticism as a Means of Self-Improvement (A)
Skill in fiscal managment: budgeting, accounting, and purchasing

Skill in conducting meetings

C. Knowledge of Program Planning and Evaluation in Environmental Health
1. Knowledge of the program planning process
a. Problem definition (program needs assessment)
(1) Tools
(a) Vital Statistics
1) Physician reporting
(b) Health indices
(c) Environmental indices
(d) Prioritization criteria
1) Size of problem
2) Seriousness of problem
3) Effectiveness
4) Benefit-cost
(e) Public participation
b. Progam Planning
(1) Constraints
(a) Legislative
(b) Budgetary
1) Inventory resources
a) Manpower
b) Budget
c) Support-services
(c) Political
(2) Resource assessment
(a) Tools
1) Performance budgeting
a) Cost of basic services can be aggregated into manpower and budgetary projections
(3) Program design
(a) Targeting measurable objectives
1) Quantification tools
a) Vital statistics
b) Health indices
c) Environmental indices
(b) Identifying program strategies
c. Program Implementation
(1) Mobilizing resources
(a) Synchronization of resources over time to help accomplish objectives
1) PERT (Program Evaluation and Review Technique)
(2) Supervising activities
2. Knowledge of program evaluation
a. Goal and objective attainment
(1) Results inventory
b. Benefit-cost considerations
(1) Activity inventory (ref: performance budgeting)
c. Feedback to above steps for program improvement
d. Record results

Skill in utilizing vital statistics, environmental and health indices
To define problems
Identify program needs
Assist in evaluation of results
Skill in arranging program needs by priority

Skill in decision-making; evaluating alternatives

Skill in assessing resource needs to implement program; e.g. performance budgeting

Skill in using program planning and management tools:
Skill in using management tools such as:
PERT, MBO and Performance Budgeting

Skill in mobilizing resources

Skill in supervising program implementation
Skill in evaluating program benefits and costs

V. KNOWLEDGE OF THE BEHAVIORAL SCIENCES

A. Knowledge of Human Needs
  1. Hierarchy of needs
    a. Physiological
    b. Safety
    c. Belongingness
    d. Esteem
    e. Self-actualization
    f. Cognitive understanding

B. Knowledge of Interpersonal Communications
  1. Among the general public
    a. Knowledge of motivational techniques
      (1) knowledge of target persons' values
    b. Knowledge of verbal communication
      (1) Knowledge of telephone etiquette
      (2) Knowledge of personal etiquette
    c. Knowledge of non-verbal communication
      (1) "Body" language
      (2) Personal space
    d. Knowledge of written communication
      (1) Mechanics of letter and report writing
        (a) Organization
        (b) Spelling
        (c) Grammar
        (d) Vocabulary
        (e) Paragraph construction
  2. With other professionals
    a. Knowledge of technical vocabulary
    b. Knowledge of philosophical orientation

C. Knowledge of Group Communications
  1. Knowledge of community organization
    a. Community power groups
      (1) Political or financial
        (a) Examples: governmental officials, both elected and employed
      (2) Key citizen's groups
        (a) Examples: PTA, LWV, labor unions
      (3) Neighborhood groups
        (a) Examples: churches, homeowner's associations, fraternal groups
    b. Socio-cultural differences
      (1) Racial, ethnic, religions, age, income
      (2) Knowledge of different environmental problems
      (3) Knowledge of importance of environmental health problems relative to other problems
  2. Knowledge of group dynamics
    a. Knowledge of how groups interact
      (1) Dominant leader
      (2) Consensus
    b. Knowledge of group decision-making techniques
      (1) NGT
      (2) Delphi
      (3) Interaction

Skill in recognizing human needs to assist in achieving compliance

Enjoys people-oriented tasks (A)
Projects a courteous manner (A)
Recognizes own capabilities and limitations (A)

Interpersonal skills
- Skill in establishing rapport
- Skill in interviewing
- Skill in exercising telephone manners
- Skill in listening
- Skill in representing departmental authority
- Skill in resolving conflict

Demonstrates emotional control (A)

Skill in consultation

Works well with others (A)

Skill in letter and report writing

Projects a respectful attitude toward other professionals (A)
Asks for advice and shares information (A)

Skill in perceiving values

Skill in facilitating consensus
Skill in conducting meetings

c. Knowledge of public involvement
(1) Citizen's advisory committees
(2) Public meetings
(3) Survey methods
(a) Interview, questionaires, public opinion polls
(4) Citizen and agency referrals

(5) Knowledge of public speaking
(a) Target audience
(b) Use of audio-visuals
(6) Knowledge of the use of mass media to educate and inform the public
(a) Types
1) Radio and television
a) Public service announcements
b) Community affairs programming
2) Publications
a) Press releases
b) Feature stories
c) Editorials
d) Pamphlets/brochures

(7) Knowledge of educational methods
(a) Knowledge of the use of behavioral objectives
(b) Knowledge of content material
(c) Knowledge of evaluation techniques
(d) Knowledge of the use of resources

3. Knowledge of interagency coordination
a. Knowledge of jurisdiction and permit issuance
(1) Memoranda of understanding
(2) Inter-agency agreements
b. Knowledge of referral process
(1) A-95 reviews
(2) Planning referrals
(3) Environmental impact statements
(4) Federal Register

Projects a positive attitude toward the community (A)
Participates in community activities (A)
Demonstrates a public service attitude (A)
Skill in encouraging testimony
Skill in conducting meetings
Appreciates importance of one's role in the community (A)

Skill in public speaking: voice projection, grammar, elocution, eye contact, style
Skill in using audio-visuals
Skill in dealing with representatives of the mass media

Believes in value of the educational process as basis for permanent behavioral change (A)

Skill at designing content material at varying technical levels
Skill in motivating students to achieve
Skill in obtaining inter-governmental cooperation

Skill in negotiating inter-agency agreements